FEB 26 1922

VOL. 48 FEBRUARY, 1922 No. 228

Engineering Library

United States Naval Institute Proceedings

The writers only are responsible for the contents of their respective articles

CONTENTS

	PAGE
The American Colors.—Chester	167
The General Board.—Wainwright	189
The Essentials of the Radio-Compass.—Williams	203
A Future Use of Radio-Telegraphy.—Quinby	217
Principles of Command.—Chandler	233
An Ideal Navy Supply Depot.—Sharp	251
A Note on Off-Shore Positions as Determined by Sextant Altitudes of Distant Mountain Peaks.—Schuyler	259
Discussion	263
Secretary's Notes	273
Professional Notes	277
Notes on International Affairs	321
Review of Books	331
Information Index	275

Copyright, 1922, by J. W. Conroy, Trustee for U. S. Naval Institute

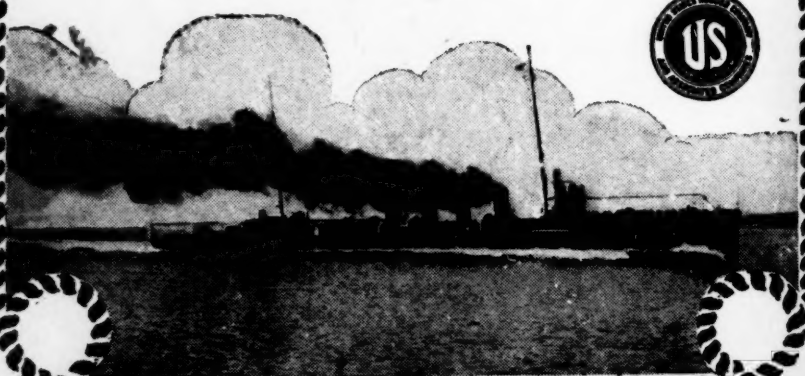
Published monthly by the George Banta Publishing Company, Menasha, Wis.
Executive and Editorial Offices, United States Naval Institute, Annapolis, Md.
Entered as second-class matter at the Post Office at Annapolis, Md.
Application for additional second-class entry at the Post Office at Menasha, Wis., pending.

Keds

MATCH your "whites" with Keds, the superior canvas rubber-soled shoes. Cool and comfortable, neat and durable, Keds are the ideal summer and tropical footwear for men of the Navy.

United States Rubber Company

US



Vol. 48, No. 2 February, 1922 Whole No. 228

United States Naval Institute

Proceedings

PUBLISHED MONTHLY
EDITED BY F. M. ROBINSON

U. S. NAVAL INSTITUTE
ANNAPOLIS — MARYLAND

COPYRIGHT, 1922
By J. W. CONROY
TRUSTEE FOR U. S. NAVAL INSTITUTE

The Collegiate Press
GEORGE BANTA PUBLISHING CO.
MENASHA, WIS.

The writers only are responsible for the contents of their respective articles

CONTENTS

THE AMERICAN COLORS. By Rear Admiral Colby M. Chester, U. S. Navy 167

THE GENERAL BOARD. By Rear Admiral Richard Wainwright, U. S. Navy 189

THE ESSENTIALS OF THE RADIO-COMPASS. By Lieut. John E. Williams, U. S. Navy..... 203

A FUTURE USE OF RADIO-TELEGRAPHY. By Captain John G. Quinby, U. S. Navy (Retired) 217

PRINCIPLES OF COMMAND. By Rear Admiral Lloyd H. Chandler, U. S. Navy 233

AN IDEAL NAVY SUPPLY DEPOT. By Lieut. Commander Walter D. Sharp, (SC), U. S. Navy 251

A NOTE ON OFF-SHORE POSITIONS AS DETERMINED BY SEXTANT ALTITUDES OF DISTANT MOUNTAIN PEAKS. By Commander J. L. Schuyler, U. S. Navy 259

DISCUSSION 263

SECRETARY'S NOTES 273

PROFESSIONAL NOTES 277

NOTES ON INTERNATIONAL AFFAIRS 321

REVIEW OF BOOKS 331

INFORMATION INDEX 275

OFFICERS OF THE INSTITUTE

President

REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY

Vice President

REAR ADMIRAL HENRY B. WILSON, U. S. NAVY

Secretary and Treasurer

LIEUT. COMMANDER F. M. ROBINSON, U. S. NAVY

Board of Control

REAR ADMIRAL BRADLEY A. FISKE, U. S. NAVY (*ex officio*)
REAR ADMIRAL HENRY B. WILSON, U. S. NAVY (*ex officio*)
BRIGADIER GENERAL GEORGE RICHARDS, U. S. M. C.
CAPTAIN JOHN HALLIGAN, JR., U. S. NAVY
CAPTAIN J. A. FURER, (C. C.), U. S. NAVY
COMMANDER JOHN DOWNES, U. S. NAVY
COMMANDER J. O. RICHARDSON, U. S. NAVY
COMMANDER H. D. COOKE, U. S. NAVY
LIEUT. COMMANDER F. M. ROBINSON, U. S. NAVY (*ex officio*)

PAST PRESIDENTS

ADMIRAL DAVID D. PORTER, U. S. NAVY, 1873
REAR ADMIRAL JOHN L. WORDEN, U. S. NAVY, 1874
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1875–JAN. 1878
COMMODORE FOXHALL A. PARKER, U. S. NAVY, JAN. 1878–JAN. 1879
REAR ADMIRAL JOHN RODGERS, U. S. NAVY, JAN. 1879–JAN. 1882
REAR ADMIRAL C. R. P. RODGERS, U. S. NAVY, JAN. 1882–JAN. 1883
REAR ADMIRAL THORNTON A. JENKINS, U. S. NAVY, JAN. 1883–OCT. 1885
REAR ADMIRAL EDWARD SIMPSON, U. S. NAVY, OCT. 1885–OCT. 1887
REAR ADMIRAL STEPHEN B. LUCE, U. S. NAVY, OCT. 1887–OCT. 1898
REAR ADMIRAL WM. T. SAMPSON, U. S. NAVY, OCT. 1898–OCT. 1902
REAR ADMIRAL H. C. TAYLOR, U. S. NAVY, OCT. 1902–OCT. 1904
REAR ADMIRAL C. F. GOODRICH, U. S. NAVY, OCT. 1904–OCT. 1909
REAR ADMIRAL RICHARD WAINWRIGHT, U. S. NAVY, OCT. 1909–OCT. 1911

U. S. S. ALFRED

The first battleship ever owned by the United States of America, commissioned at Philadelphia, Pennsylvania, December 23, 1775, Lieutenant John Paul Jones commanding. He received her into the Navy on December 3, by hoisting the "Grand Union Flag," the first "Flag of America," as Jones called it, at her mast-head. Taken at the time Admiral Esek Hopkins, the first and only Commander-in-Chief the Navy ever had, took command of the fleet of six war vessels.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS

Vol. No. 48, No. 2 FEBRUARY, 1922 Whole No. 228

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE AMERICAN COLORS

By Rear Admiral Colby M. Chester, U. S. Navy

The first step undertaken by the American people towards nationalism was the passing of a resolution by the Continental Congress, assembled at Philadelphia, on June 14, 1775, appointing a committee "to consider, inquire, and report with respect to the organization of a naval force" for the protection of the United Colonies. The appointment of George Washington "to be General and Commander-in-Chief of all the forces now raised or to be raised by the United Colonies" did not become law until some ten days later, viz.: June 23, 1775. One would not pretend to imply that this initial movement on the part of the Colonists for offensive defense against the unjust acts committed by Great Britain towards our forefathers, was taken with a view to organizing a national government in this country. At this early stage of revolution, nearly all of the twelve different colonies in America, Georgia not yet being represented in the convention, had absolutely prohibited their delegates to the Continental Congress even to discuss the question of separation from the mother country. The leaders of the great revolution, however, such as Franklin, the Adamses, Patrick Henry and Jefferson, then clearly saw the handwriting on the wall and were first, last and all the time in favor of establish-

ing a new government "of the people, for the people, and by the people." John Adams, who did more towards the establishment of the Navy, and, indeed towards the inauguration of the American flag than any other one man in the country, outside of the Navy itself, clearly had this new government in mind when he voted for the resolution to establish a belligerent force entirely under the control of the United Colonies. Later, despairing of getting the delegates in Congress to favor separation from the Kingdom of Great Britain, he wrote his wife, "As to declarations of independence, be patient. Read our privateering laws and our commercial laws. What signifies a word?" Also Franklin, when the motion was before the Congress to establish a volunteer navy, as the privateers rightfully should be called, moved that it be preceded by a declaration of independence, as the act in itself, said he, was but a declaration of war and war meant independence.

The Marine Committee, appointed by Congress, to inaugurate the first offensive movement against the common enemy, naturally knew but little of such matters as they were called upon to consider, except Robert Morris, the distinguished financier and shipping merchant of Philadelphia, but he was so busily engaged on many matters presented for his consideration as not to be able to give much time to purely naval subjects. Therefore a Board of Experts composed of four Master Mariners was called upon to assist the Committee, and the first sailor man commandeered for the purpose was Captain John Paul Jones, "a distinguished citizen from Virginia," who early in the conflict had offered his services to his adopted country in case of war. The cornerstone of naval structure, later to become the greatest Navy in the world, may now be found in concrete form on the monument of "The Founder of the American Navy," in Potomac Park at the foot of the Capitol of the Nation. It is composed of the memorable words of Captain John Paul Jones to the Continental Congress on September 25, 1775, regarding the personnel of the Navy.

Now the very first step undertaken after the formation of a civic society is the establishment of a banner of some kind to represent what the organization stands for and to rally its members. Particularly in the case of a navy intended to act upon the seven seas of the world a flag is an essential part of the organization. International law requires that all ships afloat in neutral

waters should carry the flag of some recognized nation, otherwise they may be charged with piracy and sent into port for trial by Admiralty Courts. Land forces, on the other hand, come under the jurisdiction only of the governments controlling the territory and it is a matter of no importance to aliens what colors they carry. In the case of the American Colonies colors were a matter of indifference to the enemy, for to him all the rebels appeared "to be tarred with the same brush" and a shot fired in the direction of any old flag was sure to hit a culprit, if it hit at all. As far as state troops were concerned, they did not and would not wear a banner representing a union of rebellious forces until after the promulgation of independence on July 4, 1776, and even then the flag of the colony to which they belonged meant more to them than any union symbol could do. States' rights sentiment in the north in revolutionary days was stronger, even, than it was in the south in the rebellion period.

On the other hand the Navy was a truly federal force from the time of its inception. Its members were all enlisted, commissioned and directed in the name of the United Colonies, and the states from which they came had nothing to do with them. The first measure to be taken up by the Board of Master Mariners, of which Paul Jones was the working head, was, therefore, the question of establishing a flag for the force. Ships were necessary to form the fleet, but a ship without a flag was as defective as one with no rudder. A rudder was required to steer the vessel through the shoals and dangers of the sea, while the flag was to guide her through the equally troublesome waters of international comity.

What then should the colors be?

It must be remembered that in the year 1775 there was no concerted thought in the minds of the members of Congress looking towards separation, and the British King was still the head of the existing government, therefore the Union Jack of Great Britain was selected for the union, or canton, of the flag. The crosses of St. George and St. Andrews, representing the union of England and Scotland, formed the basis of the flag and to the red field of the then British standard six white stripes were superimposed, forming thirteen alternate red and white stripes. These same thirteen stripes in association with the cross of St. George only had been worn as the standard of British

Admirals, on board their flag ships, for nearly a hundred years before adoption as a part of the "Flag of America," as John Paul Jones called it. They offered an appropriate symbol, therefore, to represent the new "fleet in being" the Americans were about to establish.

The Grand Union Flag, thus designed, and so officially styled in the first Signal Code issued by authority of Congress to American men-of-war, stood for the Mother Country to which the Colonies still belonged and the "sea power" of the budding republic. This emblem of sovereignty was authorized some time during the summer of 1775. This statement is supported by the fact that when Congress, on the thirteenth of October of that year ordered the fitting out of two vessels to proceed to the eastward and try to capture two British transports known to be coming from Scotland to Nova Scotia (loaded with supplies for the enemy), the sloop *Hornet* lying in Baltimore harbor, was one of the vessels selected for the purpose, and a Grand Union Flag was sent from Philadelphia to be hoisted on board that vessel when commissioned for service. *The Biographical Dictionary,* compiled by Thomas J. Rogers, in 1824, in referring to Commodore Joshua Barney, U. S. N., mentions the incidents connected with the commissioning of the *Hornet* as follows:

> Returning to Baltimore early in October, 1775, Barney obtained the situation of Master's Mate in the sloop *Hornet,* commanded by Captain Stone, and on receiving a flag from Commodore Hopkins he placed it upon a staff and with drums and fife beat up for volunteers, and in one day engaged a crew for the vessel. This was the first flag of the United States seen in the State of Maryland and Barney claimed some credit for carrying it.

The story is also related with rather more detail in the private journal of Barney himself.

On the thirtieth day of October, 1775, Congress having received the report of the Naval Committee drawn up by Captain Jones, passed an act appropriating money for the purchase of a number of vessels to form the navy. This date may be called the "Birthday of the American Navy." The vessels selected by the Jones Board were soon refitted as men-of-war and, on December 3, 1775, at Philadelphia he placed in commission the first battleship the country ever owned, by hoisting the Grand Union Flag

at the peak, while at the same time as temporary commanding officer he had hoisted at the mainmast head of the *Alfred*, his own narrow, or "commission pennant" as it is called in the service. On the twenty-third of December following Congress commissioned General Esek Hopkins of Rhode Island, a sailor of distinguished record, as Commander-in-Chief of the Fleet, the *Alfred* becoming Flag Ship of the force and the vessels were practically all in service before the end of the year.

So much confusion has arisen over the question of the title for the Colonial flag, which is frequently called the "Cambridge flag," that it seems important to explain away such contentions. The State troops of which General Washington assumed command on the third of July, 1775, were not organized as a Continental Army until January 1, 1776, as will be shown by the following copy of an order issued by Washington himself. On that date the "Grand Union Flag" which had been worn by naval vessels for some months, was hoisted for the first time by the Army and by irresponsible authorities it was called the "Cambridge flag" because it was noted in the British newspapers as having been seen at Cambridge on January 2.

General Washington's order reads:

Headquarters, January 1, 1776.

Parole:—The Congress—COUNTERSIGN: America.

This day gave commencement to the New Army, which in every point of view is entirely Continental, the General flatters himself that a laudable spirit of emulation will now take place and pervade the whole of it. . . . This being the day of the new establishment.

On January 4, following, Washington wrote his Secretary, Colonel Joseph Reed:

On that day, the day that gave being to our new Army, but before the proclamation came to hand, we hoisted the Union flag as a *compliment* to the United Colonies.

Later, on the twentieth of February, 1776, Washington himself prescribed the colors to be worn by the Army specifically, as will appear from the following copy of a General Order publishing Acts of Congress and regulations concerning flags:

As it is necessary that every regiment should be furnished with colors, and that the colors should, if it can be done, bear some kind of similitude to the uniform of the regiment to which they belong, the Colonels with

respective Brigadiers and the Q. M. General may fix upon such as are proper and may be procured.

Now let us see what was being done by the Navy regarding the flag. According to the news press of Philadelphia the substance of which was duplicated in Newburn, N. C., repeated by a correspondent in Nassau, on the Island of New Providence, and published in London, the first American Fleet ever organized in the last of December, 1775, sailed "from Philadelphia midst the acclamation of many thousands assembled on the joyful occasion, under the display of a Union flag, with thirteen stripes in the field, emblematical of the thirteen United Colonies." After some delay, the six vessels under the command of Admiral Esex Hopkins took their departure from the Delaware Capes on February 17 with the same flags that had been displayed at Philadelphia snapping before a strong breeze freshening for a northeast gale of wind.

On the third of March, 1776, Admiral Hopkins, carrying the war directly into the enemy's territory, captured the port of Nassau, in the British West Indies, over which for a time was hoisted the American Flag. He also captured the Governor of the Province, whom he brought home to keep as a hostage to prevent the enemy from treating their prisoners as rebels. But a more beneficial result of the engagement arose from Hopkins' bringing away as spoils of war nearly a hundred heavy guns and tons of munitions, which fell into our hands "to hearten our troops on shore," as Washington said, "and bring about a new issue to the campaign." Some of the guns figured on nearly every battlefield of the war. This first victorious conflict of the war with the enemy was followed by victory after victory on the sea by the little regular navy of the Colonies, later supported by the volunteer navy authorized by Congress on March 23, 1776, making a total force of some 1,400 combatant ships, manned by over 70,000 seamen and marines, engaged during the war. These were equal in power to as many regiments of infantry of the average strength of that early period of the country's history, or to a land force of 350,000 infantry.

On the fourth of July, 1776, America declared her independence from the mother country and a new nation was born. Up to this

time the country possessed no official flag to represent it. A flag had been established for the Navy by authority of Congress but it now became essential to own a real national flag. This matter was especially important to the sea forces and naval officers did their part towards bringing about the establishment of the flag. As early as December, 1776, Commodore John Barry commanding the Delaware fleet with headquarters at Philadelphia, argued with the Board of Admiralty that it was essential that his vessels be provided with suitable flags to go into battle, and begged that a design for a flag be approved that he might have some made for the fleet. Still Congress delayed action. Everyone recognized that it was a naval question, as it has been from its inception up to the present time, but landsmen in Congress knowing nothing of maritime matters would not, and did not, for a long time after independence, concern themselves with the subject. Pages of the *Congressional Record* of the war period are given over to acts relating to the Army, but rarely can you find the Navy mentioned in its files.

The naval service was naturally satisfied with the red and white stripes, floating under which it had already won glory (and they represented "a fleet in being"). It is a notable fact that Commodore John Paul Jones, who received the first salute to the American Flag, which gave recognition abroad to the country as a nation, selected for his own personal Commodore's broad pennant, a flag made of red, white and blue stripes with the American Jack in the corner, thus showing the disposition of the Navy regarding the stripes. The stripes were therefore fixed as far as the Navy was concerned, but what should be substituted for the Union Jack of Great Britain in the Grand Union Flag? The New England States had already used the star in some of their ships' flags and it was natural in those stirring times to look towards the heavens for a selecton of objects for the field of the flag. There still exists in Boston an original copy of the *Massachusetts Spy*, dated March 19, 1774, containing a song on the anniversary of the Boston Massacre:

> A ray of bright glory now gleams from afar,
> The American Ensign now sparkles a star,
> Which shall flame wide through the skies.

Naval officers had drawn up the design for the flag and urged its adoption. Robert Morris, now the efficient Secretary of the War Board, lent his aid to secure action by Congress. As early as February, 1777, in dispatching the first of the new American frigates to sea, he wrote the Captain, "Your prime duty will be to uphold the honor of the Flag." Is it conceivable that he and Captain Chew, commander of the vessel, knew not the character of the flag that was to be? The men of the navy made all its flags in those days on board ship and it is more than probable that a ready-made flag was in the locker of the frigate at the time, ready to fly the moment Congress could be induced to confirm the design. But what was especially needed was a leader, who could impress upon Congress the importance of the subject; and one was found. In December, 1776, Captain John Paul Jones had returned to Boston from a brilliant cruise in command of a squadron of vessels, during which he had captured nearly a score of the enemy's supply and merchant vessels, and as the credit, morale, and hopes of success of the Americans were then at their lowest ebb, Jones became the hero of the hour. He at once began to weight the mail pouches for the Capitol with urgent pleas that he might come there and lay his schemes for aggressive action against the enemy before the War Board. He laid particular stress upon the necessity of sending a naval force abroad, not only to carry on raids upon British commerce, but to influence foreign nations to support our holy cause.

At last the Board of Admiralty directed Jones to come to Philadelphia with the principal object of placing his plans before Congress. Upon reaching the "Quaker City" early in April, he soon had members of the national legislature calling upon him for advice concerning the activities they had in mind and eager to hear of the schemes he proposed. Possessing a most fascinating personality, which, as Lafayette wrote later, gained him the entrée to royal palaces in France, the gallant young naval officer drew about him a bevy of the pretty girls for which the capital was noted, and won his way into the hearts of the legislators through the smiles of their daughters. Jones soon secured what he wanted, the promise of an independent command abroad, but he could not appear off the coast of England with a ship flying the Union Jack

of Great Britain, such as existed at the time, and Congress must give him a suitable flag for the occasion, representing the "new constellation" that was born nearly a year before.

As Webster once said of the Washington Monument, "When the ladies took hold of the stones the monument began to rise," so it may be said of the fair sex of Philadelphia, when the ladies took hold of the stripes, the stars began to rise, and largely through their exertions, Congress took action, on June 14, 1777, and:

Resolved: That the flag of the thirteen United States be thirteen stripes, alternate red and white; that the union be thirteen stars, white in a blue field, representing a new constellation.

Resolved: That Captain John Paul Jones be appointed to command the said ship *Ranger.*

There were other resolutions included in this law of Congress, one of them stating why Paul Jones was appointed to command the *Ranger,* but as every clause in the bill related to naval affairs, it would seem, to use a paraphrase of the day, that "Congress was in session as a committee of the whole on the state of the Union," with a naval bill before it for consideration.

In the meantime some of the belles of the city formed a sewing bee and when Jones was about to take leave of the numerous friends he had made there, he was presented with the first Star-Spangled Banner ever made in the country, manufactured by the delicate hands of "the girls he left behind him." The history of this flag would fill a volume and is not to be undertaken here. Suffice it to say that this identical flag is believed to grace the National Museum at Washington today. It shows the horizontal alignment of the stars, *twelve* in number, representing a "new constellation" which by its sponsor, the Navy, has never been changed.

No other flag of national design formed in revolutionary times now exists, to my knowledge, in the country, except perhaps it be the . . . . flag hung in the State House at Boston, but this, too, shows the standard alignment of the stars as established by the Navy, refuting all claims as to the validity of painted flags with stars arranged in a circle.

The flag made by the fair sex of Philadelphia, known as the "Stafford flag," was taken by Jones to Portsmouth, New Hamp-

shire, where his new command, the *Ranger,* was fitting for sea, and, later, it floated over the *Bon Homme Richard* in the battle with the *Seraphis.* Arriving at Portsmouth on the third of July, 1777, Jones, according to what has now become a pretty well established fact, loaned his pet flag to his friend, Captain Thomas Thompson, of the U. S. S. *Raleigh,* sister ship to the *Ranger,* of which vessel, owing to the fact that she was practically ready for sea, he hoped to secure command in lieu of the *Ranger,* in case Thompson should be promoted to a shore station according to Jones' recommendation to the Board of Admiralty. The next day, being the first anniversary of the birth of the nation, great preparations were made on board the *Raleigh* to celebrate it with appropriate ceremonies, as noted in still existing newspapers of the town, the principal part of the ceremonies, in accordance with naval custom, being "honors to the flag."* The law of Congress now provides that new stars, to represent states coming into the union during the fiscal year, shall begin their existence on the Fourth of July. Consequently this date is the real Flag Day of the Navy. The number of stars still showing in the Philadelphia flag may be accounted for by the uncertainty regarding the status of South Carolina as a state in the union, at the time the ladies of Philadelphia made the flag.

Captain Thompson's commission as a Captain in the Navy, bearing the date of October 10, 1776, is made in the name of twelve states, ending with "North Carolina and Georgia," but no South Carolina is mentioned, which shows the Stafford flag was made before the Act of Congress of June 14, 1777, when thirteen stars were officially recognized. That the American National Flag was devised for the Navy, as this article implies, is supported by the correspondence of Washington, copies of which follow:

War Office, May 10, 1779.

Sir:

The Board have been frequently applied to on the subject of Drums & Colors for the several Regiments. It is impossible to comply with all the Requisitions for these Articles, as we have not material to make either

*On the same Fourth of July, 1777, but some sixty minutes later owing to difference of time, as stated by the press, a number of ships-of-war stationed in the Delaware River, off Philadelphia, were bedecked with the Star-Spangled Banner in honor of the occasion.

in sufficient numbers. We hope, however, to have in a short Time a competent Number of Drums. So soon as they are made we send them to Camp as we find many Irregularities and Inconveniences arising from delivering them or any other Articles here.

As to Colors we have refused for another Reason. The Baron Steuben mentioned when he was here that he would settle with your Excellency some Plan as to the Colors. It was intended that every Regiment should have two Colors, one the Standard of the United States which should be the same throughout the Army and the other, a Regimental Color which should vary according to the facings of the Regiments.

But it is not yet settled what is the Standard of the United States. If your Excellency will therefore favor us with your opinion on the subject we will report to Congress and request them to establish a Standard and as soon as this is done we will endeavor to get Materials and order a Number made sufficient for the Army. . . .

RICHARD PETERS.
By order.

His Excellency the Commander-in-Chief,
(GEORGE WASHINGTON.)

In a letter from the War Office, dated Sept. 3, 1779, signed Richard Peters, by order, to General Washington this appears:

The enclosed Drafts of a Standard for the Army are sent for your Approbation. The Officers will be by & by pressing for Colors & if materials can be found they shall be made when you send us your Ideas of the Plan of the Standard. The one with the Union & Emblems in the Middle is preferred by us in being VARIENT* from the Marine Flag.

In the reply from General Washington, dated Head Quarters, West Point, 14th of Sept. 1779, is the following:

I agree with your opinion, that the Standard, with the Union and Emblem in the Centre, is to be preferred with this addition, the number of the Regiment and the State to which it belongs inserted within the curve of the serpent, in such place as the printer or designer shall judge most proper.

On August 8, 1782, the War Office writes:

The Colors are ready and will be immediately sent as also the Drums and fifes as fast as they can be obtained.

The last letter in this correspondence is a letter from Gen. Washington to the War Office dated Headquarters, 11th March, 1783, reading:

The Standards I have found, examining, to be in the Care of Mr. Frothingham, Field Commissary of Military Stores. Your intimation in your last, is the first Notice, I had, of their being near me.

*Author's capitalization.

It appears from this correspondence that at some time after Sept. 14, 1779, a Standard for the United States was adopted for the use of the land forces by the War Board, but not by Act of Congress; otherwise it would have been noted in the *Congressional Record*, as all Acts relating to the Stars and Stripes were. But even this "varient" flag to the National Banner did not come into general usage during the War.

Following the custom established by the War Board, in the Revolutionary War, the Army carried a Flag "VARIENT to the Marine Flag" until 1834, when, as clearly shown by Army Regulations, the Garrison flag became the National Flag. This was followed by another change in 1841, when the Regulations of the Army required the Infantry also to carry the National Flag; but not until the year 1878 was the Cavalry called upon to do so. The change of 1834 was brought about by the fact that Dutch men-of-war entering a harbor of the United States—probably Hampton Roads—finding the Artillery flag floating over the fortifications and the Star-Spangled Banner flying from ships of war in the harbor, were at a loss to know which flag to hoist and salute. Inquiry was made as to which of the two was the National flag, and our government designated that prescribed by law on April 4, 1818. The President then gave orders that all Army Garrisons, all of which were practically under the control of the Artillery, should fly the National Banner.

This issue of the Army Regulation leads up to a very interesting question as to how the Star-Spangled Banner, which flew over Fort McHenry and inspired Francis Scott Key to write the immortal song now generally recognized as our National Hymn, should happen to be the Red, White and Blue when, at that time, fortifications were not permitted to wear the National Flag. The answer is as follows:

Fort McHenry was not a federal work, but was owned by the city of Baltimore. When the British Fleet entered Chesapeake Bay, in the War of 1812, and was engaged in harassing the territory to the south, Baltimore citizens clamored for a naval force to come and protect their city from invasion. A naval force under Commodore David Porter was doing this duty at New York and another under Commodore John Rodgers was engaged in the

defense of Delaware Bay. A Flotilla commanded by Commodore Joshua Barney, a native of Maryland, was then established by the Navy Department to protect Baltimore, and the Chesapeake shores from raiding parties from the British fleet. At the time Washington became threatened from the sea Barney's Flotilla men were called into land service and they put up at Bladensburg the only fight for the protection of the capital that took place, the land forces all running helter-skelter for Baltimore. Rodgers' and Porter's sailor brigades were hurried to the Capital as soon as possible, but only reached the city in time to drive the British ships out of the Potomac River "in great distress." Then under the clamor of the Baltimorians for sailors to come to their relief, the seamen that had acted so gallantly at Washington were hurried to Baltimore and Rodgers was placed in command of all the sea defences of the port, including six batteries and a portion of Barney's Flotilla.

In the meantime a small garrison composed of a company of regular Artillery was detailed for duty at Fort McHenry, but during the Battle of Baltimore the fort was mostly manned by a larger force of bluejackets and several companies of "sea-fencibles" belonging to the State, all the fortifications being under the command of Rodgers. Upon the invaliding of Major Armstead the immediate commanding officer of McHenry, owing to the hardships of the bombardment, Rodgers, anticipating the enemy's return to the fray, took personal command of the fort and made it the headquarters of the seaman division defending the city. He was thus employed until the people of New York and Philadelphia, fearing their cities were next to be attacked by the enemy, demanded the return of the seamen to protect them.

Thus Fort McHenry was at the time a purely naval battery, as were the five other fortifications forming the sea defenses of the port, and by right hoisted an especially large naval flag, made by the ladies of Baltimore for the Navy. It was the work of the Navy that saved Baltimore from the same fate that had befallen Washington, and in commending Rodgers for his gallant defense of the latter place, Secretary of the Navy Jones writes: "If your gallant sailors could have reached here in time, you would have had the honor of saving the Capitol from destruction." "That's the way we have in the Navy."

In the year 1795, in order to keep up with the march of events, the Naval Flag was changed from thirteen to fifteen stars and fifteen stripes, to represent Vermont and Kentucky, which states had recently joined the Union, and clamored for recognition among the stars. By 1816 five more stripes were called for under the law, to recognize the advent of five additional states which had come into the Confederacy since Independence. In the meantime it was seen that with the natural augmentation of states to the federation, the stripes must soon become only a thread-like marking hardly discernible at a distance or the size of the flag would become unmanageable. Naval officers saw the difficulties of the situation and Captain Samuel Chester Read, U. S. N., a hero of the War of 1812, proposed a scheme whereby thirteen stripes should represent the original thirteen colonies that formed the Union, while the number of stars should stand for all the States that should have entered the federation by the Fourth of July of each year.

Again it was difficult to get Congress to take action, but after two years of painstaking education a law was passed on April 4, 1818, establishing a new National Flag.

A standard flag made from the Read pattern was sewed together by the delicate hands of the Captain's beautiful wife, accepted by Congress, and immediately hoisted over the Nation's Capitol at Washington. Is such a model of our National Banner not good enough to be followed in these stirring times, when the American flag means so much to the world?

The legal claim for the immunity of the Country's flag from desecration may be summed up in the following:

BRIEF

On April 4, 1818, the Representatives of the people of the United States of America, in Congress assembled, passed a law reading as follows:

AN ACT TO ESTABLISH THE FLAG OF THE UNITED STATES

SECTION 1, that from and after the fourth day of July next, the flag of the United States be thirteen horizontal stripes, alternate red and white; the union be twenty stars, white in a blue field.

SECTION 2, That, on the admission of every new State into the Union, one star shall be added to the union of the flag; and that such addition

shall take effect on the fourth day of July then next succeeding such admission.

A proposed amendment to the flag bill establishing another type of flag for use in the Army and the Merchant Marine in accordance with British custom, was at once voted down as it was the wish of the majority that all American interests should be represented by one flag and only one. By a principle of law this negative postulate following from the resolution, prohibits any alternate to the standard flag established by Congress ever being adopted, except by the same authority that originated the design. In other words, it is the law of the land today that no other flag than the one thus legalized shall represent the American people.

As confirming this view of the case, it may be added, that by an Act of Congress adopted in 1797 the United States Coast Guard, then the Revenue Marine, holding power to act belligerently in certain matters, was provided by Congress with a flag "varient to the Marine flag"; but since the passage of the law of 1818, the Coast Guard Service is required to fly the standard flag of the United States, though permitted to use the old flag with perpendicular stripes as a "burgee" to indicate the duty on which its vessels are engaged. This shows the intent of Congress to restrict the use of any other flag than the Star-Spangled Banner to represent the country by any force whatever, even if the law itself does not prohibit such usage specifically.

Still another case may be mentioned showing the application of the law, if its context be taken in connection with the discussion which took place on the introduction of the bill.

In the Appropriation Bill, approved March 3, 1865, a section was introduced, reading as follows:

> It shall be lawful for the Secretary of War and the Secretary of the Navy and the Secretary of the Treasury to enter into contract for bunting of American manufacture as their respective services require for a period not exceeding one year and at a price not exceeding that at which an article of equal quality can be imported.

It is found in the Revised Statutes of 1878 and may be presumed to be in force today, affecting alike the three departments of the government.

The author of the bill, General B. F. Butler, M.C., from Massachusetts, full of patriotic zeal (though covertly inclined to "cheer

for the old flag and an appropriation") claimed that the colors of the bunting manufactured abroad, when exposed to the weather would run, which was not a characteristic of the American people. He therefore induced Congress to limit the use of material required in making the Star-Spangled Banner to American bunting. After this law had been enacted by Congress there was brought into the U. S. Senate Chamber a beautiful American flag made up of Red, White and Blue bunting of American manufacture, which was presented to Congress with suitable ceremonies and immediately hoisted over the National Capitol that all the world might see a real Star-Spangled Banner of Freedom.

Shall we now "play a yellow trick" on future generations and show by our actions that the flag represents a yellow-streaked race?

Speed in belligerent action at this time is more essential than ever before. No better maxim for grand strategy is available than that propounded by David Harum: "Do unto others as they would do unto you but do it first." One thing is certain that the majority of flags made of Japanese silk, or other such material, combined with an excrescent fringe of yellow wool, similar to that in common use today in the manufacture of what is called the American Flag, are not *fast* colors by any means, either as to feature of material or range of movement, and so may be objected to on that account. But witness a parade of American troops on any windy day. The color-bearers will be seen struggling to drag their silk, yellow-fringed banners against the friction of the air with a power nearly equal to that required for the advance. The flag should be carried at the head of the column, the speed of which is always regulated by that of its slowest unit. School children and sometime horny-handed soldiers even in such emergencies resort to "housing the flag" and thus belie the very root of patriotic sentiment regarding it. Oliver Wendell Holmes wrote:

> Nail to the mast that holy flag,
> Set every threadbare sail;
> And give it to the God of storms,
> The lightning and the gale.

You cannot do that with a flag handicapped in its movements by having attached to it a yellow fringe; and such a drag will delay the columns reaching the enemy.

An example of the fallacy of the present usage of the American flag is pertinent. During the occupation of Northern Mexico, by the United States Army, in 1913, it became necessary for the colors to be kept planted, at the head of the column, continuously. The strong prairie wind that prevailed in that high altitude, acting against the yellow fringe girdling the flags, soon wracked them to pieces and the fringe had to be removed or the colors housed altogether. Do you wish to strike your colors because it rains?

There is another phase of this important legal matter that should be considered before we crystallize a policy, corollaries from which may possibly produce no end of trouble in the body politic; even now it is not by any means a dead issue. It has been argued that a red, white, blue and yellow flag has been adopted by the Army and recorded in the U. S. Army Regulations, which have the validity of law. But this is a fallacy. To be sure Congress has given the Executive Branch of the government under its Constitutional right to provide and maintain an Army, the power to regulate that service and its regulations are binding *with the force of law* for that particular department. But it might as well be said that the flag adopted by John Paul Jones, with the approval of the Navy Department, in 1778, to represent the U. S. European Naval Squadron, under his command, a flag composed of the same stars but with stripes of three colors—red, white and blue—also represented the Nation. Nobody outside of the Army, unless specifically designated by Congress, to be under the orders of the Secretary of War, is bound to comply with Army Regulations; which, unless impeached, stand for the land force only. General Grant himself, as Commander of the Army, refused to obey an executive order, issued by the President, because it was, palpably, opposed to the will of the people, thus setting an example that has been followed more than once.

NOTE—On November 23, 1921, Senator Walsh, of Montana, offered a resolution, in the U. S. Senate, requesting the President to authorize the delegates to the Conference on Limitation of Armaments to display a flag made by adding a white border to the national standard, "thus bordered as a peace flag." The resolution was promptly, and properly, laid on the table under the axiom that the Star-Spangled Banner, "unadorned," was always a symbol of peace.

This shows that even the President has no authority to add to the colors of the American Flag without the authority of Congress.

If it be a rule of action that the Secretary of War may add another stripe to the flag that Congress has declared shall represent the people of the United States, and may demand for them a national salute, why should not any civic society order a green fringe to be placed on the Star-Spangled Banner, to represent their special interests, or the I. W. W. give it a fiery red color, or the pacifists bind it around with a boa of white feathers? Consistency, thou art a jewel. Inconsistency, in this case, may mean death.

THE SANCTITY OF THE FLAG

The American Flag is composed of three colors and three only. The RED stands for the blood of our forefathers who formed the Nation as well as for the red corpuscles which shall fill the veins of all future generations living in this country. In other words, for Roosevelt's "red blood of Americanism." The WHITE, as stated by Washington, "will go down to posterity representing liberty." The BLUE typifies the Heavens from which we borrow the stars to represent "a new constellation," the home of the God in whom we trust as well as the deep blue sea that covers three-quarters of the terrestrial globe and in war, controls its little brother the land on which we live.

"The Sea is the Lord's and He made it" and

> Perhaps the Master walks the sea
> As once he did of yore.
> And that is why it seems to be
> A part of Heaven's floor.

That flag is peculiarly a naval institution for it was made by and for the Navy, to be carried on the Country's First Line of Defense warning all aliens that "thus far shalt thou come and no further" with malicious designs on a free people.

The Navy has carried that flag to victory in wars with Great Britain, France, Spain and Germany; with Morocco, Algiers, Tunis and Tripoli, once powerful nations before which all the civilized world bent the knee; in Mexico, Paraguay and Colombia; in conflicts in China, Japan and Korea and in many other minor wars of which your histories make no mention.

The Navy has made that flag honored in every part of the world from the very tip of the ice-bound pole in the waters of

the northern aurora-borealis, where Peary planted it, to the Continent of Antartica, discovered by Admiral Wilkes of the Navy, under the Southern Cross; from the "Cradle of Liberty," at Philadelphia, "where it was born, to and through Hermit Asia, carried hence on the white wings of American battleships commanded by Perry, Shufelt and Dewey; into the pall of 'Darkest Africa' and so on, still westward ho! back to 'the land of the brave and the home of the free.'"

The Navy, under Paul Jones, was the first and only force ever to hoist that or any alien flag over the soil of Great Britain, the strongest peace ambassador ever sent to Europe. The Navy flung that starry banner to the breeze over the captured port of Derne, in Tripoli, to teach Africa and all the world the American doctrine of "millions for defense but not one penny for tribute." The Navy, in 1847 as well as in 1913, hoisted that flag over the City of Vera Cruz and would have forced it to be saluted at Tampico, as was done a short while before, at Laguayra, but for the wireless that took the matter out of its hands. The Navy was the first branch of the National Defense to display the Banner of Freedom over the new-found colonial possessions in the Philippines, fixing solid the John Hay policy of the "open-door" in Asia. That same thirteen-starred boat flag of the Navy that was planted by Dewey in the Far East now graces the Hall of Fame in Washington, where all who run may read the purpose of the Flag. With such a record as this would you teach your children who sing the National Anthem that there is a yellow strain in "Columbia, the Gem of the Ocean" it represents? And has the Navy that has born, bred, and mothered that glorious banner for a century and a half, double the time of any other fostering care—no call to bespeak for the tri-color the reverence due its birth?

And now let the author ask with all the patriotism and love of the flag born of more than half a century of service under the Star-Spangled Banner, if it is the intention of the American people to add another color to the red, white and blue, under whose folds millions have fought, bled and died to raise the country to the rank of the First World Power, inspired to valiant deeds by the oldest, most battle-scarred LOYAL Standard in existence? And, if so, is that color to be a "yellow streak," which, by common consent, has come to stand for the lowest and meanest stratum in the human race? Even a yellow dog made so by nature, is a

target for tin pans and the abuse of children and you resent a charge of playing a "yellow trick." But leaving aside all sentiment regarding the color, do you want to superimpose another tint than the red and blue on the basic white set as a standard for liberty by Washington?

Colonel Henry Watterson, the Poetic Songster of the Bluegrass Region, in a stirring tribute to the Flag delivered at the bier of Francis Scott Key, the author of our National Anthem, said:

> The Star-Spangled Banner! Was ever Flag so beautiful, did ever Flag so fill the souls of men? The love of women; the sense of duty; the thirst for glory; the heart throbbing that impels the humblest American to stand to his colors fearless in the defense of his native soil, and holding it sweet to die for it—the yearning that draws him to it when exiled from it—its free institutions and its blessed memories, all are embodied and symbolized by the broad stripes and bright stars of the nation's anthem.

This is not done by the appended yellow fringe that draws the flag down to be the plaything of faddists. You cannot paint the lily-of-the-valley, nor can you beautify the rose of Sharon. And no more can you grace the American Flag with furbelows.

To naval officers, accustomed, during a life-long service to the country, to pay daily obeisance to the flag floating over their heads with all the reverence of a lover to his sweetheart; actuated in the performance of duty by the constant prick of pride in his ship and realizing that any faulty appearance of the national colors signifies, to seamen, an ill-conditioned man-of-war not tolerated in any well-disciplined navy in the world; reminded by the Articles of War that court-martial and death await the man "who shall not do his utmost to uphold the honor of the flag," a scene that occurred in New York, on Flag Day, 1921, appeared most pitiful. There, on a day set apart by the National Legislature for special honors to the flag, was hung, in the dome of the City Hall, a number of so-called national flags bound with yellow and giving the appearance of a mass of goldenrod, the yellow tint outranking and veiling the tri-color ordained by the American people to represent unity, liberty and concord, and yet they had no thought or purpose of committing, or permitting without protest, a "yellow" act of any kind. At the same time there was taking place on Broadway a parade of several thousand school children, who were being taught to pay proper respect to their country's flag; but in that mile-long column of young Americans only one

really American flag was visible. It, at best, was nothing but a small toy flag showing the traditional colors authorized by Congress to represent the Nation, partly stripped from its slender staff, the glorious stars of the Union hanging upside down—the seaman's signal of distress—giving the appearance of being ashamed of its being seen in the long line of mud-color, which dominated the procession. The sight brought more than one invective against that yellow streak. Is such a picture of sailing under false colors a fitting object-lesson when calling children to "Rally Around the Flag?" Then, paraphrasing the greatest songster of flag literature:

Tear down that mottled yellow streak,
Too long has it waved on high;
And many an eye has dimmed
To see that jaundiced color fly.

And let there appear to your minds that divinely painted picture, that only a sailor afloat upon a tropical sea may view when at the close of day, with tender thoughts in his mind of dear ones at home, whom he is protecting on the first line of defense, there appears Old Glory at the masthead of some passing vessel rising higher and higher in the skies, while the setting sun, dipping its golden head below the distant horizon, mingles its expiring rays of effulgent streamers with those of the beautiful flag he loves; the scarlet red coming out of the west, reflected along the white crested waves of the sea, all scintillating under the fading lights of a star-lit dome of Heavenly blue.

Red stripes and white for strength and right,
Speed on thy message, speed!
Guard that blue strain of Heavenly light,
Thine starry field with visions bright,
To meet a nation's need.

Viewing such a scene as this there will surge through every fibre of your bodies that electric wave of patriotism, which Roosevelt once described, that will spring forth from the depth of your very souls, in ever-swelling tones—"Three cheers for the Red, White and Blue."

NOTE: Delivered before the District of Columbia Society Sons of the American Revolution; and the Military Order of the Loyal Legion of the United States.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE GENERAL BOARD

A Sketch

By Rear Admiral Richard Wainwright, U. S. Navy

The name General Staff is very much under a cloud at present because of the influence of the German General Staff in precipitating the late World War and its barbarous method of conducting it.

A General Staff is only an organization of military experts formed to carry on the business of war. Any large business, unless it has experts to conduct it, must lack in efficiency and where only backed by private money must prove a pecuniary failure. Our railroads, long governed by experts in transportation, are now showing the results of experiments with expert financiers at their head. Some of our colleges are trying the same experiment. The results may not be apparent yet, but the cause of education will prove the loser in the long run. An Army or Navy may win success even when its affairs are conducted by amateurs, but the cost in lives and property must be enormous. A review of the costs of our wars from the first to the last will show how much could have been saved if the preparation and execution had been in the hands of experts.

Such an organization as a General Staff may become a danger to its own country and to the peace of the world when its immediate head is a paranœic backed by a military aristocracy and by a people who are indoctrinated with the belief that broken faith and cruelty are not wrong when they benefit the country.

With our government as organized and with the general sentiments of our people, there is no danger of militarism. The civil element always should and always will dominate and the military experts will always have to struggle for reasonable preparation and against amateur interference in the conduct of war. It is im-

portant to the safety and welfare of the country that the governing machinery for Army and Navy should be as efficient as possible and the most efficient machine so far developed is that of a General Staff. The administrative and legislative bodies control the policy of the nation and the military and naval experts under them control the military policy that is required by that of the nation.

The General Board was established by order of the Secretary of the Navy, John D. Long, on March 13, 1900, General Order No. 544, as follows:

> A General Board is hereby established, to be composed of the following named officers: The Admiral of the Navy, the Chief of the Bureau of Navigation, the Chief Intelligence Officer and his principal assistant, the president of the Naval War College and his principal assistant, and three other officers of or above the grade of lieutenant commander.
>
> Should the principal assistant of the Chief Intelligence Officer, or the principal assistant of the President of the Naval War College be below the rank of lieutenant commander, an officer or officers of the grade of lieutenant commander or above will be designated to fill such place or places on the Board.
>
> The purpose of the Department in establishing this Board is to ensure efficient preparation of the fleet in case of war and for the naval defense of the coast.
>
> The Chief of the Bureau of Navigation will be the custodian of the plans of campaign and war preparations. He will indicate to the War College and Intelligence Officer the information required from them by the General Board, and in the absence of the Admiral of the Navy, he will preside at meetings of the Board, and exercise the functions of president of the Board.
>
> The Board will meet at least once a month, five of its members constituting a quorum, and two of its sessions every year shall extend over a period of not less than one week each, during which time the Board shall meet daily.

Accordingly, on March 29, 1900, Secretary Long ordered the following officers who constituted the first membership of the Board:

Admiral George Dewey, Senior Member;

Rear Admiral A. S. Crowinshield, Chief of Bureau of Navigation;

Captain C. D. Sigsbee, Chief Intelligence Officer;

Lieut. Comdr. R. T. Mulligan, Asst. to Chief Intelligence Officer;

Captain C. H. Stockton, President Naval War College;
Captain Asa Walker, Asst. to President Naval War College;
Captain R. D. Evans,
Captain H. C. Taylor,
Captain C. E. Clark,
Captain F. E. Chadwick, and
Colonel Geo. C. Reid, U. S. M. C.

On April 14, 1900, Lieutenant Henry H. Ward was ordered to duty as Secretary of the Board.

On April 16, 1901, the original order (G. O. 544) was modified by General Order No. 43, which read as follows:

> General Order No. 544, of March 13, 1900, republished in General Order No. 1, of June 30, 1900, is so far modified that the General Board will be composed of the following named officers:
>
> Admiral George Dewey, President
> The Chief of Bureau of Navigation
> The Chief Intelligence Officer
> The President of the Naval War College, and
> Such other officers of or above the grade of lieutenant commander as the Department may designate.

This remained the composition of the Board until the adoption of the "Aid" system in the organization of the Department, when the Chief of the Bureau of Navigation was omitted, and the Aids for Operations, Material, and Personnel became members. ex-officio.

When these offices were abolished the Chief of Naval Operations became an ex-officio member, and later the Major General Commandant of the Marine Corps was added as an ex-officio member.

It was due largely to the efforts of then Captain, afterwards Rear Admiral, Henry Clay Taylor that the Navy owes the creation of the General Board. Early in his career he commenced the study of war and he continued an ardent student until his untimely death. Before the Spanish War he was President of the War College. He commanded the *Indiana* during that war and was among the first members of the General Board; afterwards, as Chief of the Bureau of Navigation, he was able to further his ideas which were concentrated on a General Staff. To him as much if not more than any one else we owe the persistent attempts to have

naval affairs controlled by naval experts. Well he knew that the General Board was only a step in the right direction.

To Lieutenant Commander T. B. M. Mason and Commander, afterwards Rear Admiral, B. H. McCalla we owe the establishment of the Office of Naval Intelligence, a most necessary section of any form of a General Staff. Mason laid the foundations of the Office broadly and firmly. It immediately became of value to the service and has grown in value and importance with the growth of the Navy. As the nation gradually awoke to the necessity of a navy, the Office of Naval Intelligence furnished information of foreign material and enabled us to benefit by the experience of other countries. War plans were also included in the duties of the Office and with our then decrepit fleet the plans dealt more in things hoped for than in existing force. The Office of Naval Intelligence was the first step in the direction of organized preparation for war. The next step was the War College; its establishment we owe to Rear Admiral S. B. Luce, who urged its establishment, was its first president, afterwards lectured there and was always ready with his aid and advice until the end of a long and honorable career. The Navy owes much to his continuous efforts to promote the study of war and to forward the idea of the control of the affairs of the fleet by naval experts.

For many years the classes at the War College were little more than conferences of officers fresh from the fleet, directed in their studies by the College staff and instructed by lecturers on war and diplomacy, the most eminent of these being Admiral Mahan, whose lectures on Sea Power were highly valued by all seagoing peoples.

There were few students of war in the Navy when the College opened and for some years the lessons that could be drawn from the fleet were of little value; the staff and students had to study the tactics and maneuvers of other naval powers and to draw upon their imaginations for future fleet operations on our coast. The use of tactical and strategical games was slowly developed while the students were guided in their reading of the old masters of the art of war and their studies of former battles, both naval and military. The fleet grew in size and quality, and as the knowledge of war was disseminated by the College students, the exchange of

theories from the College with experiences from the fleet became valuable and the study of tactics and strategical plans required less exercise of the imagination and a closer attention to facts. Logistics, tactics and the application of strategy to the war games became less theoretical and more practical.

Prior to the blowing up of the *Maine* but when war with Spain seemed only a question of time, the Department instituted a Defense Board upon the urgent request of Admiral Taylor, then President of the War College. The members were the Commander-in-Chief of the North Atlantic Fleet, the Chiefs of the Bureaus of Navigation and Ordnance, the President of the War College and the Chief Intelligence Officer. Both the War College and the Office of Naval Intelligence presented studies or plans for the war with Spain, at the first session of the Board. Under the direction of the Board and under the immediate eye of the Commander-in-Chief, plans were prepared in the Office of Naval Intelligence and were approved by the Board. They were corrected from time to time, but for lack of any central naval authority became obsolescent before the advent of war.

There was another Board, some of whose functions were taken over by the General Board. Soon after we commenced to build a real fleet, the Department constituted a new Board. The Board on Construction consisted of the Chief of the Bureau of Ordnance, the Chief of the Bureau of Equipment, Chief of the Bureau of Steam Engineering, the Chief of the Bureau of Yards and Docks, the Chief of the Bureau of Construction and the Chief Intelligence Officer. They recommended to the Department the military characteristics of all new vessels. Each Chief of Bureau was deeply engaged in the immediate work of his own specialty and they had little time to devote to the general consideration of the plans for a well balanced fleet. Besides they were very careful how they opposed each other's ideas, as each one wanted the votes of the others for his own special ideas. The decisions of this Board were not always approved by the Secretary. Once when the issue was the plans for several new torpedo boats, the military members all decided to adopt plans similar to a British type, the largest then built, that had proved quite successful and was somewhat larger than any we had attempted. The Chief Constructor wanted to

adopt a much smaller boat after a French design, one purely experimental and one the designer admitted had been built as an experiment to obtain speed in a small boat without serious consideration of other military factors. The Chief Constructor took his minority report to the Secretary and obtained a decision in his favor by the argument that as torpedo boats were sneak boats, the smaller they were the better they could sneak upon the enemy, and all questions of seaworthiness, endurance or armament were brushed aside. It was only by the great influence of Admiral Sampson, then Chief of the Bureau of Ordnance, that the Secretary was induced to reverse his first decision and make a 50-50 one. The big boats proved good for their time; the small ones proved a failure and were called the Bath Tubs. Although well constructed at Bath, the design was a failure. Thus was money wasted and progress retarded by the decision of a civilian who lacked the groundwork of knowledge upon which to found his decision.

The General Board took under consideration questions of naval policy, the size and composition of the fleet, the military characteristics of the various types, the numbers, etc., of the personnel, war plans, as well as many minor questions that from time to time were referred to it by the Department. The Board had no executive functions and was limited to advising and reporting to the Secretary, and its advice and reports were held confidential except when it was desired to gain popular support to some plan of the Department when a report of the General Board was quoted in its favor. It was more the knowledge that Admiral Dewey was the President of the Board that gave any weight to its decisions than any public knowledge of the composition and workings of the Board. Even such a report did not always do full justice to the Board, for at times the document quoted would be in direct reply to questions from the Department that were so prepared as to limit a free expression of opinion. One was often reminded of the story of the creation of the Charleston Navy Yard. A Board was ordered to investigate and report on two sites for a Navy Yard, one at Charleston and one at Port Royal, as to which was the better. This Board reported that Charleston was the better site, but urged weighty objections against both of

them. The report of this Board was used to secure the necessary legislation, only the weighty objections were omitted and another log was rolled.

The work was divided between the regular members, who formed heads of committees to consider the subjects under their charge, and from time to time they met together as an executive committee and prepared matter for the consideration of the full Board, or as occasion required an emergency report for Admiral Dewey's signature.

The size and composition of the fleet with the military characteristics of each type required much discussion and long consideration, and a report was sent to the Department some time prior to the time when the Secretary made his annual report. As the Government has never adopted any naval or military policy, the General Board, in its considerations of the subject, generally considered the correct naval policy, for the time prior to the late war, to be a fleet sufficient to render a successful landing of any possible enemy on our shores practically impossible. Under this policy, it was necessary to have a fleet greater in strength than any power with sufficient military organization and sufficient transportation to land an expeditionary force of a size to give reasonable expectations of success. Prior to the late war our army was so small as to make the size of such a force within the power of two military nations, Germany and Japan. The question of two fleets for two oceans was very important prior to the Panama Canal; the completion of the canal modified the difficulties.

The Board was obliged to consider the effect of their report upon the Administration and not to attempt to obtain everything necessary at once. Rarely if ever were the necessities of the Navy, as reported by the General Board, met by legislative appropriation until the very large program of 1916, advocated by Mr. Daniels, met with the approval of Congress, and such is fate, this was at a time when all our efforts should have been devoted to turning out craft fitted for anti-submarine warfare. Usually the recommendations of the Board were returned with directions to report on what could be best spared so as to cut down the appropriation.

The recommendations of the Board as to military characteristics have generally met with a better fate. These recommendations,

made after conferences with the Chiefs of the Material Bureaus, were usually adopted. One year the size of the battleships was materially reduced because of the weight of opinion of some small ship advocates with an influential Senator. Once the after-cage mast was placed between funnels, but this absurdity was never repeated. In accordance with the recommendations of the General Board, as advised by the principal naval experts in Construction, Engineering, Ordnance, etc., the designs of American battleships have gradually increased in size and in weight of armor and armament. Turrets have been maintained on the central line in spite of foreign examples of broadside and wing turrets, and the principle of tall and short turrets has been adopted. Propulsion has gone from reciprocating to turbine engines and now to the electric drive, and we have also led in the adoption of fuel oil. We have gone from 12-in. to 16-in. guns with corresponding armor protection.

For at least thirty years American battleships have had greater military efficiency than their foreign contemporaries, except for the Dreadnought. That Americans did not build the first all big gun battleship was not the fault of American designers. The all big gun principle had been ably presented to the General Board and sketch designs of the U. S. S. *Possible* had been exhibited, but it was not the policy then of the General Board to rival the "greatest navy in the world" in size of battleship, only to get a little more battle efficiency on the same tonnage. It is doubtful if it was to Great Britain's advantage to so force the race for size and power by building the Dreadnought for, as it placed in the background, if it did not render many of her fleet obsolete, it made it more difficult for her to keep her preponderance in sea force over her great sea rival, Germany. With the advent of the Dreadnought, as Germany would follow, it was necessary for America to build Dreadnoughts and Superdreadnoughts; and it is not from want of recommendations and urgent reports that America has not always led Germany in number of capital ships as she has done in their design.

As to armored cruisers and battle cruisers, we have always been behind in the race. The latter we have just commenced to build. While our fleet was small their necessity was not so apparent and

appropriations being limited, battleships were recommended as being most necessary. As there has always been a sentiment for many small ships against a smaller number of large ones, so there has always been a sentiment against sacrificing armor and armament for speed and against building a due proportion of battle cruisers in place of all battleships. This sentiment has been more difficult to reason down than the one for small ships and it was not until the 1916 program that appropriations were made for battle cruisers. War was then inevitable; now that the war is over, the battle cruisers are slowly building.

The General Board early set a standard of four destroyers to a battleship. Of course, that is far too few for present warfare with modern submarines, but too many to suit legislative ideas. In design we were generally a little behind our rivals in speed, but our Constructors and Engineers, backed by the Board, held out for heavier scantling and larger parts than were usual abroad. Certainly they were justified in the late war when their superior sea-keeping qualities were manifest.

Although submarines were an American invention, we were backward in developing them and we had not reached a very useful type when we went into the war. It was only through the great energy and pluck of our young officers that the best of ours were made useful. The General Board was not urgent to build large numbers of these as a fleet type had not been developed. It was evident the design was capable of improvement and recommendations were made to carry out the wishes of the enterprising young officers who were familiar with the practical workings of the submarines, as far as the designers and builders consulted by the Board thought possible.

Airplanes were in their infancy and were being slowly developed prior to the war. The rapid development of submarines and airplanes during the war caused some to forget the great cost in life and treasure as well as the enormous interests involved that served to produce this rapid increase in efficiency. When certain results have been reached, the General Board is accused of conservatism because they have not recommended the earlier adoption of an imperfect weapon. Public sentiment and even public welfare prevents the rapid development of weapons of warfare

where such development must be at the cost of life and large appropriations, and it is wise to provide for the use of the old and well tried instruments until the new have been perfected sufficiently to be relied on in war. Admiral Fiske, writing on the defense of the Philippines, states that he had recommended that reliance for their defense be placed in airplanes. This was made at a time when the efficiency of the plane, even as a scout, was all to be developed in the future. One is reminded of Admiral Sir Percy Scott, the great prophet of the submarines. Both Admirals have rendered important services to their respective countries, both have large imaginations and are gifted with a prophetic *flair*, but their advice for present, everyday work has not always been the best. Prophesies of the future are not always the best foundation for present needs. Had this character of advice been followed, our destroyers would have been some time without torpedoes while the ten thousand yard torpedo was being developed and the shore of the Philippine Islands littered with wrecks of imperfect airplanes. To prophesy for the future the head may be in the clouds, but to provide for the present the feet must be firm on the ground.

If one searched the records, there would be few years found in which the General Board failed to recommend an increase in the personnel of the fleet and to urge the importance of trained men to man the ships composing it. It seemed difficult to believe that men could not be found when the emergency arose, if the ships were ready. Even now, after the experience of the war, appropriations are made to build more ships while the personnel provided is insufficient to man efficiently the present fleet and the fuel allowed insufficient for their proper training.

The General Board recommended a scheme for a Naval Reserve that would have proved of considerable value when mobilizing for war, but it failed of adoption. It made many recommendations as to the promotion of officers and with the aid of Captain Roy Smith perfected a scheme for selection out that if adopted might have proved more efficient and less unpopular with the service than the present system that is now under revision by the Department.

War plans were the constant study of one committee of the General Board and from time to time the results of these studies

were considered by the full Board. From time to time portions of the plans were given to the War College for consideration and report. This custom arose when the permanent staff of the College was not greatly pressed by work during the winter and the summer sessions were largely conferences of a body of officers fresh from the fleet; but when the College was developed into a real school for instruction and the work continued through both summer and winter, all work on war plans was withdrawn from the College.

It has been said that there were no war plans. These plans were revised from time to time and kept up to date. They were as complete as existing knowledge permitted and, where large policies were involved, received the approval of the Department. The plans were more or less incomplete; it must be remembered that there is danger of limiting the initiative of the Admiral Commanding with too complete game board plans. The completeness of the first von Moltke's plans for war with France have been misunderstood. They were no doubt most complete, but von Moltke was too great a war genius to limit the initiative of his generals by interference with their minor strategy or greater or minor tactics. When Mr. Daniels was asked by the Hale investigating committee for the General Board's plan for the war, he answered "Search me." *After his departure from the Department, his desk was searched and the plans found;* and it is safe to assume that had this plan been followed many things would have been undertaken at once, that either never were started or were undertaken some time after we entered the war on paper. At least there would have been less grounds for the serious strictures on the administration of the Navy made in the very valuable report of the above-mentioned committee.

The General Board recommended the abolition of a number of our Navy Yards and the building up of several Naval Bases, where the fleet could dock, repair, re-fuel and equip, but during the orgy of spending inaugurated by the war the yards were expanded and the Navy drawn into a riot of shipbuilding. There is no doubt that this expenditure is being curbed by the present Secretary and if the Council to consider the limitation of armament is as successful as all good citizens hope, there will be much

machinery at all the yards that we will find it difficult to dispose of before it becomes obsolete.

New weapons have arisen and new means have been found to handle them and to provide against them. So many refuse to believe that "the best prophet of the future is the history of the past." For all time he who uses demonstrated facts to guide his footsteps will be called radical by the conservative and called conservative by the radical. We now have a prophet who declares that troops can no longer be carried across the seas and it is only a few months since we sent two million men to France with but negligible loss from shore to shore. The cry during the war was that the methods of warfare were new and required new men for generals, men who were not imbued with old military ideas. Yet the great general of the war, the one who was uniformly successful, was a thorough student and a luminous teacher of military lore; and when given the necessary power Foch, at his first opportunity, took advantage of the Germans' often-repeated error and, holding them in front, struck them in the flank, and the Germans were being driven to colossal disaster when Foch's forces were arrested by a politicians' armistice.

A Joint Board composed of officers from the General Staff of the Army and the General Board of the Navy was a slight approach toward a Grand General Staff. It was created to advise the President on weighty matters and to co-ordinate the work of the Army and the Navy, and it did some good work, but its work was stopped when we were being kept out of the war.

The Aid system, adopted by Secretary Myer, was a further advance toward a General Staff and the Aid for Operations took the place of the Chief of the Bureau of Navigation on the General Board. The advice of the Board was put into operation by the Secretary of the Navy through the Aid and if legislation was necessary was urged upon Congress. The Aids with the General Board and the Office of Naval Intelligence formed a species of General Staff incomplete in many ways, but the best that could be adopted at the time without legislative sanction, and it was hoped would lead to the creation of a real General Staff. The needs of the fleet were considered paramount and the value of the Navy Yards was weighed in accordance with their importance to

the fleet. Conflicting interests of the several bureaus were reconciled and adjusted and the reports of experts were studied and put in shape for the Secretary's consideration.

The next move was a step backward. The Aids were abolished and the Office of Chief of Operations was created by Congress. Unfortunately the Chief of Operations became under the law only one of several bureau chiefs; he lacked the power of a real Chief of Staff to co-ordinate the work of the bureaus. A council of bureau chiefs met, with the Secretary presiding, and the needs of the fleet were settled when a glib tongue might outweigh expert knowledge.

The General Board has aided in keeping alive the spirit of a General Staff and has supplied the need of it as far as its limited authority would permit. With a real General Staff established, a General Board, untrammeled by executive duties, considering and reporting on larger questions of naval policies would be of assistance to any Chief of Staff and would help to protect him from the annoying assaults of Galley Yarns.

It is to be hoped that we may yet have a real General Staff for the Navy; but it must be remembered that a Pershing can make a General Staff but a General Staff cannot make a Pershing; and the General Staff must refrain from attempting to keep the Admirals of the fleet in swaddling clothes.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE ESSENTIALS OF THE RADIO-COMPASS

By Lieut. John E. Williams, U. S. N.

The radio-compass, when it has become more thoroughly understood by the naval service at large, will prove a vital element of naval strategy. Many excellent articles covering various phases of the radio-compass have already been published, but an exposition that will set forth the simple theory underlying this instrument is needed to clear away the doubts entertained by many officers as to its practicability on board ship, and to banish the bugbear of how to use it.

During the World War this instrument, in a modified form, was used extensively, with excellent results, by both the British and French, to locate ships at sea. Its use required but about one minute of transmission by the ship, and about ten minutes more for plotting and coding by the shore stations. At the end of this time the ship's position was sent broadcast in code. As a matter of interest, it may be noted that on several occasions, our own destroyers, in position approximately two hundred miles off the west coast of Ireland, have checked the accuracy of these radio-fixes by simultaneous starsights, with an average resulting compass error of about five hundred yards. Since the Armistice, a method similar to that of the British has been perfected by the U. S. Naval Radio Service and is now used by our navy with ever-increasing confidence.

One cruise of the U. S. S. *Edwards,* from San Francisco to San Diego, may be quoted as significant of the reliance which may be placed on the radio-compass. Taking departure from the light ship (San Francisco) at noon Feb. 9, 1921, and cruising through continuous fog, a course was set well to seaward for safety. Dead reckoning was carried forward allowing for the set and drift of

seasonal currents. At about 4:00 A. M., Feb. 10, and well to the westward of Santa Barbara Island (about 30 miles) the course was changed to pass Santa Catalina Island two miles abeam to starboard. A continuous check by radio-cross-bearings from shore stations had been maintained, and these radio-fixes checked the dead reckoning position within a quarter of a mile at all times. Both were verified as correct by subsequent forenoon and meridian sunsights, as well as by cross-bearings on Santa Catalina Island.

As a further example of the application of this instrument, the U. S. S. *McCall,* equipped with a home-made Bellini-Tosi direction finder, adapted to unit direction, and essentially the same as the present day radio-compass, was, on May 26, 1918, able to make contact, through a fog, with the 14,000 ton freighter *Rathlin Head* which had been torpedoed in both the engine and firerooms as well as in the forepeak. By her timely arrival the *McCall* was able to force the submarine to submerge, and successfully salvaged the *Rathlin Head,* escorting her, under tow, to Bantry Bay, a distance of one hundred and twenty miles. In order to render the use of the radio-compass more general, and duplicate in everyday cruising the foregoing results, it is desirable that *officers in general* become familiar with its theory, for only by mastering the theory may the use of the radio-compass on shipboard be made reliable. Once the essential details have been mastered, however, the operation of the radio-compass becomes simple and inherently accurate, and it is the endeavor of this article to make clear these essential features by considering the chief factors entering into its construction, in their logical sequence: (1) The action of a stone thrown into a pool of water, as similar to the propagation and characteristics of the radio wave; (2) The stress set up in ether by the charged transmitting antenna, together with its characteristics; (3) A brief consideration of the electric generator principle, as applied to the exploring coil of the compass; (4) An investigation of the properties of the closed loop (or exploring coil) with its vector curve of signal strength; (5) The signal strength of a vertical antenna as a vector quantity; (6) The vector combination of the loop and vertical antenna when used to obtain unit direction; and (7) Probable errors, to be met in the use of the radio-compass, and their elimination.

Consider a stone, thrown into a pool of still water. It would be hard to find a man unfamiliar with the series of concentric circles radiating from the center of disturbance. Now consider yourself located at a point P (Fig. 1) on the instantaneous circumference of one of these circles, and let it be required to find the direction of the center of the disturbance "C." A simple geometrical solution at once presents itself. Draw a line A P B tangent to the circle at P, and construct a line P Q normal to A P B at P. This normal, then, passes through the center of disturbance "C." The application of this principle will be evident when the action of the loop antenna is considered later.

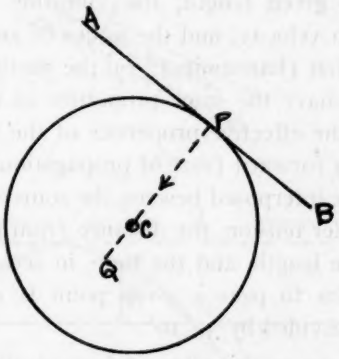


Fig. 1 A

Proceeding from water to ether as a medium for the transmission of energy, and from the stone to the transmitting radio-antenna as a source of energy, one is interested to note the similarity that exists between these two. Experiment has repeatedly verified the theory that radio energy as it exists in the form of ether stress is similar to the propagation of sound, heat, and light energy in the form of wave trains through the same medium. It has further been determined that these energy wave-fronts exhibit themselves as loci of spherical surface of constantly increasing radius, and, further, that in the case of the radio train the velocity of this surface away from the source of energy is 3×10^8 meters per second. In ether as in the case of the ocean wave, the individual particles do not move appreciably forward, but rather, oscillate in a minute elliptical path, transmitting their

energy from particle to particle and forming in water the familiar, visible wave on which a floating cork will move up and down but not forward. Each wave has its crest (maximum amplitude), its trough (minimum amplitude), its node (a point vertically halfway between the crest and trough), and its wave length (λ) equal to its forward velocity divided by its period. Again, the wave train in ether may also be likened to a violin string set in vibration by a bow. This string has nodes of zero motion and loops of maximum motion. If its limiting positions were to be projected on a vertical plane, it would be evident that its vibration had taken the form of a sine curve rotated about its neutral axis. For a string of given length, the vibration travels along the string at a certain velocity, and the nodes of zero vibration maintain a fixed position (harmonics). So the particles composing the radio wave train have the same properties as those of the ocean wave as well as the effective properties of the violin string. The wave front moves forward (rate of propagation) with the velocity of light, the space interposed beween the source of energy and the wave front is under tension, the distance from trough to trough is equal to the wave length, and the time, in seconds, necessary for succeeding troughs to pass a given point is equal to the wave length in meters divided by 3×10^8.

Like the violin string, this alternately expanding and contracting radio-wave-stress-in-ether is composed of two stresses (Fig. 2) at right angles to each other and mutually at right angles to the direction of the forward motion of the wave-front along any particular radius. The vertical stress is an electro-static stress which does not materially influence the present subject. *But the horizontal or electro-magnetic stress is the foundation on which the theory of the radio-compass is based.* Since we are considering a variable magnetic-stress it is convenient to regard it in terms of the value of its instantaneous flux, which, in turn, is proportional to the instantaneous amplitude of vibration of the wave front, and is conveniently expressed by the ordinate "ϕ" of the sine curve (Fig. 3.) This value "ϕ" is in phase with the transmitting oscillation.

In order to connect this magnetic flux with the compass loop, one need only remember the principle of the familiar electric

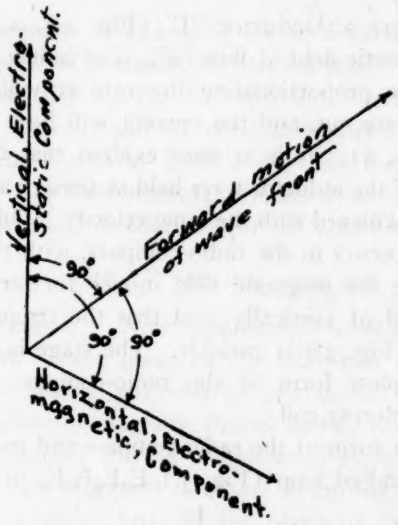


Fig 2

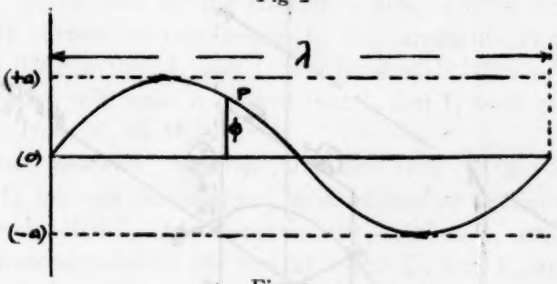


Fig. 3

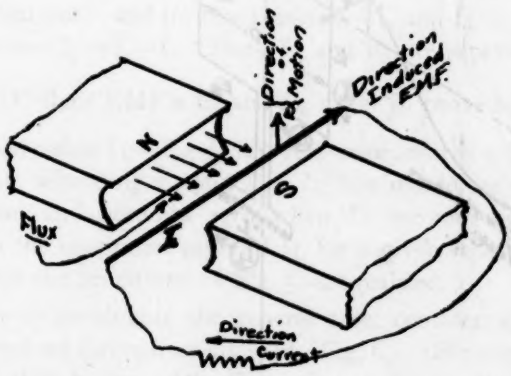


Fig 4

generator, where an inductor "I" (Fig. 4.) is moved upward through a magnetic field of flux "ø". The induced E. M. F., and current will be proportional to the rate at which the lines of magnetic flux are cut, and the current will flow in the direction indicated (Fig. 4). It is at once evident that the same results would obtain if the inductor were held stationary and the magnetic field moved downward with the same velocity. This latter arrangement is what occurs in the radio-compass, with the single exception that there the magnetic field moves forward with uniform velocity instead of vertically, and that the strength of the field (as shown by Fig. 3.) is variable. The stage is now set to consider the simplest form of the radio-compass, i. e., the loop antenna or exploring coil.

The simplest form of the radio-compass and in its simplest case consists of a closed loop (Fig. 5.) $E_1E_2E_3E_4$ in whose circuit a

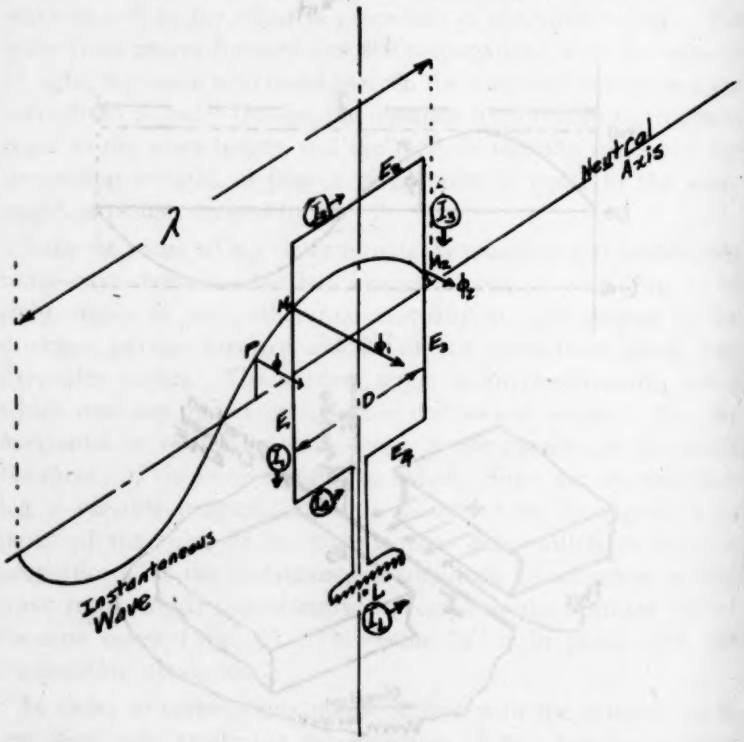


Fig. 5

load "L" is inserted. This loop is set on a vertical axis and is rotated until its plane contains the vertical trace of the incoming radio wave. Let E_1, E_2, E_3, E_4 represent the EMF's induced in the legs of the coil, and let it be understood that upon the properties of these several EMF's depends the action of the compass itself. Let the horizontal dimension of the loop be "D" meters. Now from a consideration of the velocity of the wave it is evident that any point "P" on the wave will cut E_3, $\frac{D}{3\times10^8}$ seconds after it cuts E_1. Now superimpose an *instantaneous* section of the wave on the plane of the loop, and let M_1 and M_2 represent the successive positions of any point "P". Then the instantaneous values of magnetic flux ϕ_1 and ϕ_2 (assumed to right for positive ordinates) will be proportional to the ordinates M_1 and M_2, and in turn represent the "rate of cutting" of E_1 and E_3, (since they are perpendicular to the plane of the loop). The direction of current, by the corkscrew rule, will be downward. Hence if current be represented by the same subscripts as the induced EMF's, then I_1 and I_3 will buck each other. A similar consideration will make it evident that I_2 and I_4 buck each other and flow from M_1 to M_2.

We are, however, directly interested only in the resultant current I_L through the load, and an inspection of the figure shows that $I_L=I_1-I_3+I_4-I_2$. Now in the case of I_4 and I_2, the instantaneous value of the rate at which E_4 and E_2 are cut by the flux is the same for both (since their midpoints are in the same vertical line), and for this reason $I_4=I_2$ and I_L is reduced to the expression $I_L=I_1-I_3$. Since E_1 and E_3 are separated by the distance "D" their EMF's E_1 and E_3 differ in phase by $\frac{D\times360^\circ}{\lambda}$, and the expression $I_L=I_1-I_3$ is a real value, and is a function of the distance separating E_1 and E_3. I_L is a maximum when D is a maximum and becomes zero when D becomes zero. This shows that the maximum value of I_L for a given separation, (D) occurs when the conditions of Fig. 5, are realized.

In order to investigate the general case, consider the loop of Fig. 5., revolved through an angle Θ (Fig. 6). The separation of E_1 and E_3 then becomes $D'=D\cos\Theta$ and the resultant current,

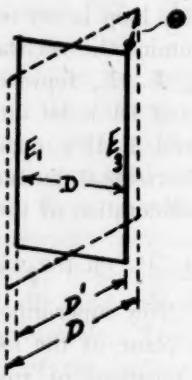


Fig 6

I_L, which is a function of D′ (general position) may now be exactly expressed by the equation $I_L = k \cos \Theta$, where k is a constant, determined experimentally for the loop in question. This, ($I = k \cos \Theta$), is the polar (vector) equation of a circle whose center is displaced a distance $\frac{k}{2}$ from the polar origin, (Fig 7). This circle traces itself completely from $\Theta = 0°$ to $\Theta = 180°$, and retraces itself in the same direction from $\Theta = 180°$ to $\Theta = 360°$. There are, then, two maximum values, one at $\Theta = 0°$, and one at $\Theta = 180°$. There are two zero values, one at $\Theta = 90°$, and one at $\Theta = 270°$.

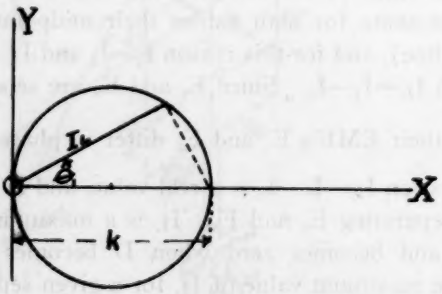


Fig. 7

If now a telephone receiver, in conjuction with a suitable radio receiving set, be substituted for the load "L", a signal will be heard. This signal will be a maximum when $\Theta = 0°$, or 180°, and

will be zero when $\Theta=90°$ or $270°$. The natural question, "What does all this prove?" may be answered by calling your attention to Fig. 1, and pointing out that the center of the loop is the point "P", that the electro-magnetic stress component of the radio wave

Fig 1

is the tangent A P B, that the plane of the loop contains the line P Q (the normal to the tangent at its point of tangency), and that this plane, continued, passes through the source of disturbance (the transmitting antenna). But it will be noted that we have obtained a line of position and not an absolute direction

It is possible, however, to obtain an absolute direction by the addition of a vertical antenna. This vertical antenna is located on the axis (extended) of the loop, hence the instantaneous flux cutting it is the same as that considered for the loop, and its phase is the mean of ϕ_1 and ϕ_2. A suitable receiving set utilizing a vertical antenna is characterized by a signal of constant strength, irrespective of the course of the ship, and the equation of its current is $I_V=K$ (a constant), which is the polar (vector) equation of a circle of radius K whose origin is at the center (Fig. 8).

In order to form a combination of these two curves, ($I_V=K$; $I_L=k \cos \Theta$), we resort to the simple expedient of coupling these two currents inductively. The loop forms a load in the secondary of a receiver (Fig. 9.) whose primary is connected to the vertical antenna and to ground. The coupling is adjusted until K=k (method will be explained later), and from a consideration of the two equations it is evident that the resultant current $I=I_L+I_V=K+k \cos \Theta$. And since K=k, $I=K(1+\cos \Theta)$ which is the polar (vector) equation of a cardiod, which has only *one* value of Θ ($=180°$) corresponding to a zero

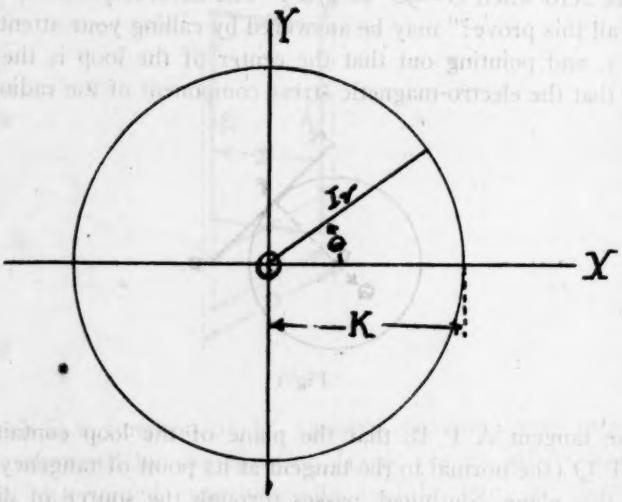


Fig 8

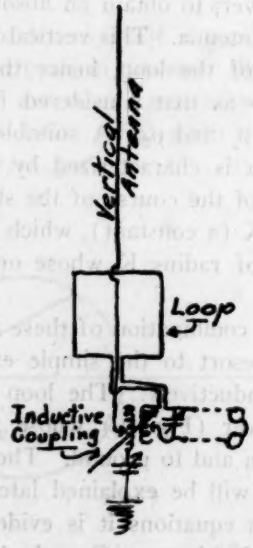


Fig. 9

value of I. This resultant curve is shown in Fig. 10, where, since we now have but one position of zero current (or zero signal), we have eliminated one of the bilateral directions of the original line of position, and have obtained the absolute direction (unilateral) of the source of disturbance (the transmitting antenna).

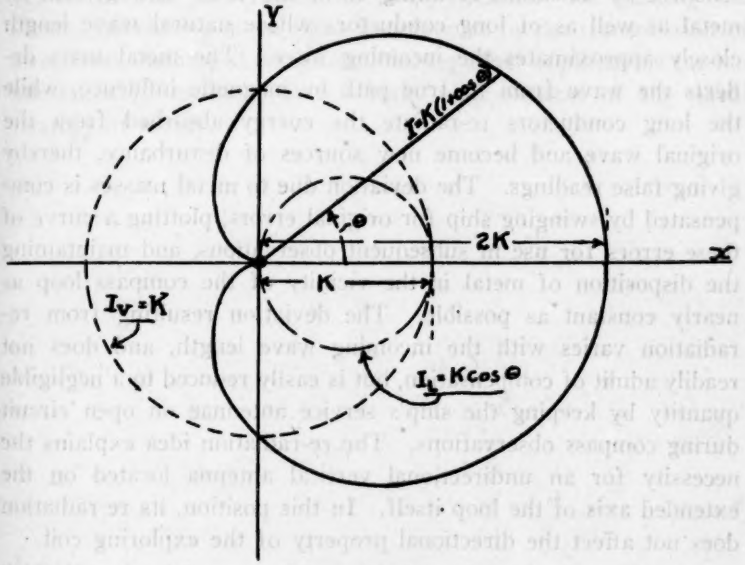


Fig. 10

Though the explanation of the cardiod may seem complex, the practical application is simple. In order to obtain this cardiod it is necessary to make big K equal to little k. This is accomplished in the following manner. (1) Tune both the primary and secondary to agree with the incoming signal. (2) Open the primary circuit and note the maximum signal strength resulting from the loop alone. (3) Rotate the loop through 90° (to zero signal strength). (4) Close the primary circuit and adjust the coupling until the signal strength resulting from the primary (vertical antenna alone) is equal to that which was heard when the loop *was* in its position of maximum signal strength. You have now adjusted the instrument to satisfy this requirement.

Inasmuch as it has already been shown that the action of the radio-compass is based on a magnetic flux, it will readily be

appreciated that errors similar to the variation and deviation of the standard magnetic compass may be expected. Variation, resulting from the deflecting action of metal deposits along the path of the wave, is reduced to a minimum at sea and may be safely neglected. On the other hand, the radio-compass is very sensitive to deviation resulting from the local arrangement of metal as well as of long conductors whose natural wave length closely approximates the incoming wave. The metal mass deflects the wave from its true path by magnetic influence, while the long conductors re-radiate the energy absorbed from the original wave and become new sources of disturbance, thereby giving false readings. The deviation due to metal masses is compensated by swinging ship for original errors, plotting a curve of these errors for use in subsequent observations, and maintaining the disposition of metal in the vicinity of the compass loop as nearly constant as possible. The deviation resulting from re-radiation varies with the incoming wave length, and does not readily admit of compensation, but is easily reduced to a negligible quantity by keeping the ship's service antennae on open circuit during compass observations. The re-radiation idea explains the necessity for an undirectional vertical antenna located on the extended axis of the loop itself. In this position, its re-radiation does not affect the directional property of the exploring coil.

It has been the intention of this article to explain the "WHY" of the radio-compass, by drawing the reader's attention to the fact that the compass loop is actually the armature winding of an electric generator, whose magnetic flux is supplied by the incoming radio wave, and that by determining the position of minimum (or maximum) induced EMF the direction of the flux, and consequently of the incoming radio wave, has been determined. It seems unnecessary to burden the reader with the minute details of construction, installation, and use. These details are fully treated in the Bureau of Engineering's Radio-Compass Bulletins, No. 6, (The Construction of Apparatus Used in the U. S. Naval Radio-Compass, Ship and Shore Stations), and No. 5B, (Operation of U. S. Naval Radio-Compass Equipment on Shipboard).

In the present era of enlightenment, no mariner hesitates in the use of the standard compass, and many mariners now use radio-

bearings from shore stations as equally reliable. The radio-compass installation on board ship is inherently accurate, and its use is of absorbing interest. The desired precision in operation is but a question of practice, and, with practice the radio-compass will become of inestimable value for locating our own or enemy vessels at sea, for cruising in heavy weather, for guiding sea planes, for cutting down radio-interference by the transmission of *directional* undamped waves, and among other applications far too numerous to mention, as a certain vital element of the naval strategy of to-day.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A FUTURE USE OF RADIO-TELEGRAPHY

By CAPTAIN JOHN G. QUINBY, U. S. N. (Retired)

A Résumé of its Progress—Its Application to Navigation, and Trans-Oceanic Flights—"Fixings" in Aerial Flights rendered "Practically Instantaneous"—THE SPHERICAL CHART-TABLE, Manufacture and Use explained, and what is and can be accomplished by its use.

The writer treats of this subject under progressive headings giving a brief résumé of the progress-of-the-art which has come under his personal knowledge. It can be readily understood that Radio or Wireless Telegraphy is in its infancy, practically born during the last generation, and that many people now alive saw its birth heralded and have witnessed or read of its progress in the daily press. It will be treated in a more or less chronological manner in order to approach methodically its main object.

This main object is to show how the radio-compass bearings received at shore stations in the ship-to-shore method can be applied without interpolations or logarithms to determine the location of a ship (surface or aerial), almost instantaneously—using the Spherical Chart Table. This method can easily be adopted—as is shown—to locate these ships, if bearings are obtained by the shore-to-ship method. Both these methods are treated of. The size and manufacture of this "Spherical Chart Table" is, of course, subject to be governed by external considerations—no standard size is yet determined.

As the paper progresses towards its conclusion, some corollary uses are suggested by the writer, and doubtless many others will occur to the bright minds who may or may not read this paper.

ARRANGEMENTS OF HEADINGS

1. Radio or Wireless Telegraphy—Its History and Development.

2. The Radio-Compass, Its Development.
3. Radio-Compass Corrections, Ashore and Afloat.
4. Possibilities of Its Use for Surface Craft.
5. Its Use for Surface Craft.
6. Difficulties of Plotting Bearings Received.
7. The Two Methods of Obtaining Bearings Available.
8. An Easy Solution Proposed—the Spherical Chart Table.
9. The Method of Plotting Positions.
10. Concluding Résumé.

HISTORY OF RADIO, OR WIRELESS TELEGRAPHY

When the writer was in attendance at the Naval War College in 1896, the question of distant communication between ships was considered a knotty problem, and the Navy was doing its best to solve this problem. Outside of the use of Carrier Pigeons, the senses of sight and hearing only were under consideration, that is, visual or audible communication between ships in extended formation. Search light reflections on clouds were successfully tried at night and 30-mile communications sent and answered. A signal gun was estimated to be audible 10 miles—if conditions were favorable.

Marconi came along after the Spanish War, and in 1901-02 Naval vessels equipped with Slaby-Arco, Tellefunken or other sets were soon communicating up to 50 miles. But little was known of "interference."

As an illustration of this, during one of the International yacht races for the "America Cup" an attempt to report to their various papers, the progress of the race for bulletin information to the crowds on the street, resulted in such hopeless interference that absolutely all the money expended was thrown away. No intelligent information was received.

To those familiar with the laws regulating interference (the various methods of increasing the wave length; the "tuning up" or "tuning down" processes—now thoroughly understood—or the ability to distinguish the tone of the spark of the distant operator) such lack of knowledge would cause considerable amazement in order to properly estimate this interference.

The Navy, realizing the vast strategical advantage of radio communication, began experimenting and developing this new and untried means of communication.

About 1910, the U. S. S. *Birmingham* was heard a distance of approximately 4,000 miles and received messages practically the same distance. This shows the jump in radio-communication in less than 10 years. Governments then undertook to establish stations so that messages emanating from these stations could be heard around the world, and at present (by the use of great power and heavy expensive installations) such communication is doubtless possible or claims to that effect are made.

Changes in methods, increased knowledge and drastic regulations to prevent interference and regulate wave lengths have accomplished this vast improvement in 20 years, and radio telegraphy is still regarded as being in its infancy (1921).

The Radio-Compass—Its Development

Up to as late as 1910, it was generally believed that (as messages emanating from a given station progressed along the surface of concentric spheres whose center was the point of emanation and whose radii increased very rapidly—185,000 miles per second—being heard with equal volume anywhere on these surfaces) the direction from the point of emanation to point of reception was undefinable. About this time it was discovered it was possible to detect and define this direction. That is, the direction of the sending station from its point of reception. This lead naturally to a "direction finder," and this "direction finder" has had the name of "Radio-Compass" applied to it. Various claims as to the reliability of the "Radio-Compasses" have been made, but early experiments conducted by various Governments have, in great measure, thrown doubt upon these claims, "fixes" from such compasses were found (while even "close in") to be out 5 to 10 miles.

One of the principal causes for these errors was soon discovered, and with the "corrections" due to local causes applied, it was found that the earlier claims of accuracy were well substantiated, until now, the most optimistic of operators claim accuracy to "one-quarter of a degree."

N. B.—This "claim of accuracy" would seem excessive, as it may readily be conceived that while "radio waves" travelling over open water probably stick close to the original plane of transmission, if such a "radio wave" were to pass close to a ship or headland it would be deflected more

or less. As a matter of fact, "instructions to mariners" issued by Marconi caution them to use such bearings with great care and doubt.

RADIO-COMPASS CORRECTIONS ASHORE AND AFLOAT

The "corrections" alluded to in the previous paragraphs were of course due to

First. Faulty construction.

Second. Faulty installation.

Third. Faulty location.

Fourth. Faulty application of bearings.

In regard to these the first two can only be remedied as the "manufacture" and installations are improved, and these improvements can be hastened, or retarded, only as our knowledge increases, or is allowed to lag. The *third* is the easiest and the first to be overcome. It was found that a bearing coming in was deflected at the last moment by local attractions—doubtless due to "induction" in conductors at the point of reception—that is, the radio-compass station itself. This naturally lead to care in the selection of locations and to what is known as "station calibration," and these practically eliminated the greatest part of the errors of radio-bearings received at shore stations. The *fourth* source of error was doubtless due to the ignorance of many in assuming that visual rays are "rhumb-line bearings." In reality they are great circle bearings and only for short distances can they be plotted on Mercator's—the most used—charts as rhumb-line bearings with any degree of accuracy. Coasting vessels sighting lights are usually within 10 to 20 miles of the light, and the *error* in using the compass bearing of these lights and plotting on a coasting (Mercator chart) except in very high latitudes is hardly ever over 10′ or 15′ of arc. This is doubtless increased by the difficulty of obtaining accurate bearings and in using parallel rulers accurately. The universal use of "CROSS-BEARINGS" treated as "rhumb-lines" caused this error to be continued. A straight-line-of-sight (omitting "refraction" is of course admitted) but that "straight-line-of-sight" is always in a plane which passes through the "zenith" and the "nadir" of the observer, and is therefore a "great circle" which never plots on a Mercator's Chart as a straight line,—a small error is always creeping in, it is doubtless small for short distances, but is present.—It is to be

remembered that using the "radio-compass" has the effect of enormously increasing the distance of our mental visibility, and that this increase of distance increases the error of using these bearings as *rhumb-line bearings.*

There are doubtless other sources of error that further knowledge may help to eliminate, among these may be mentioned "EARTH-CURRENTS" due to the Sun's spots and electric disturbances, and probably many others. Radio-waves are probably very susceptible to "inductive influences" the attraction or repulsion due to parallel currents being pretty well understood among electricians deserving of the name. The distance through which these "inductive influences" may cause serious bending in the direction of the incoming waves must be considered, and stations above such influences must be built, and the surrounding conductive materials must be eliminated or removed; or the location so chosen as to render this cause negligible. Having previously chosen our location, this location is then calibrated.

Calibrating a Station—Ashore

The method used is easy to understand, and simple to perform and the other considerations being eliminated by choice of location when once properly performed needs only a periodical checking.

Briefly the method is described as follows:

At each station a destroyer or tug is sent out from a station radially until it is at the limit of visibility of its searchlight rays when *pointed straight up.* It then, by radio direction from the station, brings the station abeam and keeping it abeam steams on the arc of that circle. At stated times it stops sends in *5 sec dashes* for one minute, its radio-call-letters and "K" with its searchlight turned on; the radio-compass operator using these *5 sec dashes* reads his radio-compass bearings, and another observer takes an accurate visible bearing of the search-light ray. The difference of these two is the station calibration for that bearing. The destroyer then continues along the arc of this circle and at the appointed times stops and repeats.

A tabulation of these results is the correction to apply to all readings received at that station. It is practically a "deviation table" for that station, but is differentiated from a deviation table;

as of course, a station remains on a fixed heading and the calibration is the bending of the incoming radio-wave at its point of reception—in other words, the bending of the radio-wave due to local induction set up by the relative bearing of the incoming wave with respect to the inductive materials at that station. Hence it is given the name *"Calibration"* and not deviation.

This point is accentuated here because it has an important bearing on ship's radio-compass bearings. It is the correction for a ***relative bearing*** for one heading of the station.

Calibrations for Radio Bearings Afloat

If a radio-compass be placed on a ship to determine the direction of a radio-wave sent out to that ship from a shore station, it has been found that these bearings are very much more unreliable than bearings received on shore. The most optimistic of these operators give or allow errors of 5 to 10 degrees. The difficulty here may be due entirely to changeable local conditions such as change in heat of smoke stacks, or to character of cargo. It is evident that in applying the calibration for any heading of the ship—that the relative bearing must first be estimated, and that during the reception of these bearing waves, the ship must maintain a perfectly steady course, and also the rolling and pitching of the ship would necessarily change "induction" attraction or repulsion in certain conductive materials which are necessary for ship's construction. Probably a mean of several such bearings might approach a correct bearing, but even this is doubtful, unless it were spread out over considerable time necessary to establish a reasonable ***mean*** and this, it must be remembered, means a change in the ship's position and mental gymnastics (introducing the human element) in applying these changes in relative bearings and the difficulty of keeping the ship on a steady course during this extended time interval.

The difficulties here enumerated seem to render the installation of radio-compasses on board ships for radio-bearings of doubtful value.

N. B.—This does not mean that a ship could not use such a radio-compass very effectively for other purposes. The writer has in mind a use of such a radio-compass for preventing collisions during fog.

POSSIBILITIES OF ITS USE FOR SURFACE CRAFT

The Act of Congress passed July 23, 1912, makes unlawful for all ocean-going ships licensed to carry or carrying 50 or more persons, or for vessels plying on the Great Lakes, to leave or attempt to leave any port of the United States unless that vessel be equipped with a radio set capable of sending or receiving a message *day or night* over a distance of 100 miles.

It also requires an auxilliary power supply—independent of the ship's electric power plant—which can send and receive a message for *four* hours *day or night,* over the same distance.

It requires two operators for this radio installation and a continuous watch kept.

It is therefore evident that before a ship can get its inspection papers or clearance, it must be so equipped.

This being the case, every ship must be so equipped, and these radio sets must be able to reach shore, if it be within 100 miles.

Every deep-sea navigator knows that if he can locate himself accurately when he reaches a point 100 miles from his destination, he can shape his course for his destination with reasonable certainty. The Navy Department on every Pilot Chart publishes a list of stations located all along the coast and *invites* mariners to make use of these to locate themselves—*free of charge.*

THIS LIBERALITY is in marked contrast with the custom and requirements on the coast of England (a coast notorious for its fogs, and periods of low visibility) where 5 shillings is charged for each and every bearing.

The use of these radio-bearings by surface craft renders "landfalls" certain. It has been successfully used by the writer on more than one occasion on either side of the ocean for even greater distances than 100 miles and delays and dangers escaped by its use.

In using these radio-bearings for the distances mentioned a correction was always applied, which the writer came across in the *British Nautical Magazine* by Sinbad, which will in this article be called "Sinbad's Formula." It is given herein:

$$\text{Correction (in minutes)} = \frac{\text{Difference in longitude (in minutes)}}{2} \times \text{sine "L"}$$

This formula gives the correction to apply to the radio-compass bearing received from the Shore station whose "L" (latitude) is known if the ship's position by D. R. is known,—it must be correctly applied:—*additive* to radio-compass bearing received if ship's position be to the *eastward* of radio-station; and *subtractive* if ship's position be to the *westward* of the shore station, *in northern latitudes,* our compasses being marked 0°-360°.

N. B.—Attention is again invited to the fact that by using this formula, that we are using the radio-compass bearing as a visual direction and intend to plot on a Mercator's Chart, it is sufficiently accurate for distances up to 300 miles. It being, of course, impossible to see 300 miles, the effect of the radio-compass being simply to extend our vision so that we know the direction of the "radio-compass station" 300 miles away.

It is further noted that on the back of the North Atlantic Pilot Chart for February, 1921, Mr. Collins—nautical expert for the U. S. Hydrographic Office—has given another method for correcting these radio-compass bearings, much easier to understand, but not so easy to apply—it being in fact a "trial and error" method which for the distance named (300 miles) gives the same results as Sinbad's Formula.

USE OF THE METHOD FOR SURFACE CRAFT

This method is strongly recommended for the use of "surface craft," as by its use port can always be made in thick and foggy weather. It is not considered necessary to remind mariners of the danger of collision during foggy weather, but it is done nevertheless.

N. B.—A suggestion for preventing collision during foggy weather is introduced by the writer.—If in addition to the requirement of radio equipment (Act of July 23, 1912) a small radio compass set were required to be carried and a weak call audible only two miles was required to be sent on entering and during continuance in a fog, the greatest and most dreaded danger would be practically eliminated, for if a ship's bearing be fairly established it at once becomes easy to avoid collision with that ship.

This, in conjunction with ability to shape course for port during fog, leaves little danger to be apprehended by mariners.

DIFFICULTY OF PLOTTING RADIO BEARINGS

This difficulty has been largely overcome by either applying "Sinbad's Formula" or, using Mr. Collin's method. Sinbad's method is not accurate beyond 300 miles, and the method proposed by Mr. Collins, is correct in theory, but is a "trial and error" method which should require a second application if distances are great. This latter method requiring interpolations and calculations requires time—not always at the disposal of air craft navigators.

N.B.—Radio bearings of 0° or 180° are *always* correct, and on Equator bearings of 90° or 270° are correct, and these radio bearings can be used on any chart (Sinbad's formula reducing to zero in each case).

When time is available, the method of finding the crossings of the meridians on either side of the ship's D. R. position from each radio-compass station, is the surest way, but while it can be applied by surface ships having the time, it is out of the question to use this method on rapidly moving "air craft" subject to strong air currents, something quicker is necessary here. Attention is invited to what has already been said regarding radio-compass bearings as great circle bearings.

THE TWO METHODS AVAILABLE

These are:

First. "Ship-to-shore" method.

Second. "Shore-to-ship" method.

These will now be briefly discussed under separate headings.

"Ship-to-shore" Method

In using this method, a ship at sea sends in a "Q. T. E." International query—meaning, what is my bearing? By the instruction on every Pilot Chart she does this, using an 800 meter wave length, a shore station hearing this "Q. T. E." answers "K"—go ahead. To identify herself, the ship then sends in her radio-call-letters for 30 seconds, and then makes *dashes* of 5 *sec.* for *one minute*. If during this *one minute* the radio station has determined correctly the ship's radio bearing she sends out "K", and then *spells out* the radio bearing in degrees. The ship answers this by sending back the bearing in degrees *using numerals*.

Along our coast "entrances of importance" have three radio-stations in telephonic communication with each other. These stations give a base-line long enough so that a ship within 100 miles can be accurately located, but all three bearings are sent the ship and she does her own plotting.

N. B.—Each station being calibrated applies its own calibration corrections and sends to central station or ship its calibrated radio bearing.

It is perfectly possible in this manner to locate a ship accurately enough for the ship to find port by not using Sinbad's Formula—if Sinbad's Formula be used, a ship is more accurately located, and better allowances for tides and currents can be used.

Not using Sinbad's Formula, does not necessarily lead the ship into danger; as by keeping in communication with the radio-compass station, the bearings given as you near port become more and more accurate, as by Sinbad's Formula the correction reduces to zero when the difference in longitude becomes zero.

For distances which the law requires the radio installation to be able to send, there now exists no reason for not being able to shape the course to port in the heaviest fog. As the distance increases more power must be used to reach the shore station to enable that shore station to get your radio-bearings. As stated under "History of Radio or Wireless Telegraphy" by using sufficient power a radio-compass station could obtain bearings for any distance off shore, and it follows from this that radio-compass navigation is destined to be used as the art of "radio-telegraphy" progresses, replacing the present astronomical navigation for any distances, and it follows, too, that if this radio-compass navigation can replace astronomical navigation, owing to the rapidity of plotting it will be used principally for plotting positions of "air craft" when trans-oceanic routes are established.

The main difficulty to be encountered is the difficulty an air-ship would have in carrying the weight of a sufficiently powerful sending apparatus to reach half way across the route to be used. If this handicap be overcome its possibility must be admitted.

"Shore-to-ship" Method

In a sense this is the reverse of the other operation. The shore station (which can easily overcome the handicap of weight for

sufficient power) sends out at stated intervals its radio-call-letters for 30 seconds, followed by *5 second dashes* for one minute. This powerful call is easily read by a very light radio-compass on ship, and on a receipt of a second bearing from another powerful shore station (so located as to give a good cross) the ship plots her own position.

The method of plotting these bearings will be given.

From what has been said about radio-compasses afloat, it will be at once realized that until the progress-of-the-art improves the reliability of the ship radio-compass sets; that, while the handicap upon the surface ship carrying necessary weight and costly equipment may be overcome, the *handicap* of unreliability using "shore-to-ship" method renders its use inadvisable.

Both methods are discussed, and each has its advantage over the other. In the improvement and the "progress-of-the-art" some inventors will work along one line, and some along the other and doubtless the future may find such progress has been made that either method can be used.

In which event it becomes necessary to consider the use of both methods which is done under the headings following.

AN EASY SOLUTION PROPOSED

Conditions

Considerations Governing Selection of Routes

A study of probable routes for successfully navigating an aerial craft trans-oceanicwise. shows that to cross the Atlantic with a chance of favorable air-currents covering the shortest open water space, a route must be selected starting from the vicinity of St. Johns, N. F., to Valentia, the S. W. corner of Ireland. Using this route an air-ship generally finds westerly air currents and its apex is reached in 52°—21′ N. Latitude; it passes within 750 miles of the southern point of Greenland, which is within 900 miles of St. Johns, N. F.; it passes within 700 miles of the southern point of Iceland. It is never over 1,100 miles from Horta or Corvo Island, and it passes within 750 miles of Corvo Island.

It is only 1,639 miles by closely following a great circle route from St. Johns to Valentia.

In consequence of these figures, it is evident that 850 miles is the longest distance necessary to send in wireless calls to reach some two of the five stations enumerated (which are considered necessary for the use of radio-compass navigation in crossing the Atlantic Ocean).

Certainly an apparatus capable of sending 1,200 miles would cover all the necessities for the employment of radio-compass navigation in crossing the Atlantic. It is not claimed that such an apparatus in the present "progress-of-the-art" can be carried by an aeroplane, but it is a significent fact that the ill-fated ZR-2 was reported to have a radio set capable of sending 1,200 miles. A little further study of this route reveals the fact that the limits of longitude are covered by 43° approximately. The limits of latitude 30° approximately.

In crossing the Pacific Ocean from Yokohama to Vancouver, the Aleutian Islands offering landing places and radio-compass stations and the limits of latitude from start to finish are within the limits of the trans-Atlantic route selected; and using these stops the limits of longitude are also the same.

It is thus seen that a portion of a sphere of such radius to cover 43° of longitude in the latitudes 35° to 65°—N, which roughly is (for longitude) 1/9 of this sphere, and (for latitude) 1/12 of this sphere, would give all the working surface for the navigation of both of these trans-oceanic routes.

To cross North America, Europe and Siberia, no navigation across waters is needed; therefore it is seen that with radio-compass navigation, it is possible (or soon will be) to encircle the world between latitudes 30° and 60° N.

Assuming a unit of 1/8 of an inch to 6 sea miles on the Earth's surface we obtain 1.25 inches for a degree of longitude on the Equator. A simple calculation shows that a sphere of 12 feet diameter would give 1.258 inches to a degree, therefore, a 12 foot sphere will be considered.

On such a sphere the chord of 43° of longitude in latitude 35° is *42.79 inches;* at 65° latitude the chord is *22.64 inches.* A chord for 30° of latitude on this sphere is *37.27 inches.*

Hence if we construct a table with four legs and a flat top 44 inches long, by 40 inches wide, such a table would carry the portion of this sphere of 12 feet diameter, that it is desired to use.

On the surface of such a portion of the sphere, as we are considering; viz: 43° of longitude and taking in from 35° to 65° of latitude, it is evident that the middle meridian is 21° 30′, and the middle latitude is 50°. This latitude and longitude marking the middle point of this portion is the crown of this surface of double curvature. It is the sum of the versines of the arcs of 43° and 30°, which on this 12 foot sphere, is 5.67 inches. This point is therefore 5.67 inches above the surface of the table.

A box-like cover of the following dimensions: 44 x 38.5 x 7 inches could be lined with felt and cover, and protect this surface, and is the space in which it could be stowed.

The Spherical Chart Board Described

This spherical surface can be made of any material which will not warp, and it should be marked for every degree of longitude and latitude within the limits mentioned.

The established radio-compass stations having been accurately marked by *latitude* and *longitude*, and a small pin securely fixed marking each radio-compass station, so established, around each such station a circle having a 10 degree chord of the 12 ft. sphere as a radius is drawn, or such portion of that circle as the limits of the portion of the sphere in use permits of. The meridian passing through each station will give the "zero" or the "180 degree compass" bearing. Every degree on this circle from the "zero" or "180 degree" initial points is marked. A silk cord is attached to the pin marking each radio station. The chart table is now ready for use.

The Method of Plotting, Using "Ship-to-Shore" Method

To describe the method of using this spherical chart-table the navigation of a flight will now be described by an aero-plane leaving St. Johns, N. F., bound for Valentia.

At stated intervals the aero-plane sends out calls which are received at St. Johns and Cape Farewell, Greenland, until some two other radio-stations become better situated. From St. Johns, N. F., a radio bearing of the plane is received as "a" degrees, then from Cape Farewell the bearing is received of "b" degrees. The plotter now taking the silk cord, from St. Johns radio-station in his

right hand moves it across the face of the sphere (keeping a good strain on it) until the cord passes through the point marking "a" degrees on the "compass rose" surrounding St. Johns, N. F. Taking the silk cord from Cape Farewell in his left hand, he moves that hand over the surface of the sphere (keeping a strain on the line) until it passes through the point marking "b" degrees on the "compass rose" circle around Cape Farewell. Where these two cords cross each other is the location of the aero-plane (correct within the limits of the radio-compass bearings, and the reading of the observer). Repeating this progress at stated intervals the aero-plane is located all the way across to Valentia. This is by the use of the "ship-to-shore" method.

The Method of Plotting, Using "Shore-to-Ship" Method

To use the "shore to ship" method it will be necessary to have a spherical protractor made to fit the surface of the 12 feet sphere.

On the reception of bearings by the radio-compass on the aero-plane the spherical protractor is set to these angles. One arm is made to pass through one station keeping the "zero" or "180 degree" point on the meridian, moving along approximate route, until the other arm passes through the second station, when the *centre of the protractor* will mark the ship's position.

THE QUICKNESS AND SIMPLICITY OF THESE METHODS

No plane of paper can be made on any projection that accurately describes a development of the Earth's surface without distortion, therefore it is necessary to use a spherical surface with a fixed ratio with that of the Earth. It is seen that in the methods described at length in the preceding paragraphs, no parallel ruler or logarithmic table or interpolations are used. The radio-bearings only are used without correction and the location of the ship is at once obtained. This method is mathematically correct, no errors entering into it except inherent errors through the inaccuracies of the radio-compasses and operator.

CONCLUDING RÉSUMÉ

It is seen that, by the use of "radio-compass bearings" for navigational purposes, we have dispensed with the necessity of using celestial bodies.

When the "Progress-of-the-art" reaches the point that these radio-compass bearings can be relied upon up to 850 or 900 miles (BEING INDEPENDENT OF FOGS AND CLOUDS), we are simply extending our human vision by just the extent we can rely upon the bearings as to distance.

If in addition to this extension on the human vision, we find that we can rely upon the radio-compass—as to accuracy—trans-oceanic navigation is reduced to the use of "CROSS-BEARINGS" to navigate any kind of a craft anywhere on the surface of the ocean, provided suitable radio-compass stations be established. Moreover, this navigation can be made practical, mechanical, and instantaneous.

Using the silk cord from the found position of the vessel, to the destination gives at once the course and distance.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

PRINCIPLES OF COMMAND

By REAR ADMIRAL LLOYD H. CHANDLER, U. S. Navy

KNOWLEDGE OF THE PRINCIPLES UNDERLYING THE CREATION AND MAINTENANCE OF HIGH MORALE, LOYALTY, AND MILITARY CHARACTER AS A FACTOR IN MORALE

MORALE

What is *morale?* The dictionaries give us:

Morale—Conditions as affected by, or dependent upon, such moral or mental factors as zeal, spirit, hope, confidence, etc.; mental state, as of a body of men, an army, and the like. (Webster's *New International Dictionary.*)

Morale—State of mind with reference to confidence, courage, zeal, and the like, especially of a number of persons associated in some enterprise, as troops. (Funk and Wagnall's *New Standard Dictionary.*)

These definitions are satisfactory as far as they go, but in dealing with so intangible an asset as morale some further elucidation of the term is required, and for this purpose the writer can present no better explanation of the full meaning of the word morale, as applied to a military force, than that given in a recent book by William E. Hocking, entitled *Morale and Its Enemies,* which explanation reads as follows:

Perhaps the simplest way of explaining the meaning of morale is to say that what "condition" is to the athlete's body, morale is to the mind. Morale is a condition; good morale is a good condition of the inner man; it is the state of will in which you can get most from the machinery, deliver blows with the greatest effect, take blows with the least depression, and hold out for the longest time. It is both fighting-power and staying-power and strength to resist mental infections which fear, discouragement, and fatigue bring with them, such as eagerness for any kind of peace if only it gives momentary relief, or the irritability that sees large the defects in one's own side until they seem more important than the need of defeating the enemy. And it is the perpetual ability to come back.

From this it follows that good morale is not the same as good spirits or enthusiasm. It is anything but the cheerful optimism of early morning, or the tendency to be jubilant at every victory. It has nothing in common with the emotionalism dwelt on by psychologists of the "crowd." It is hardly to be discovered in the early stages of war. Its most searching test is found in the question, How does war weariness affect you?

Fitness and readiness to act, the positive element in morale, is a matter not of good or bad alone, but of degree. Persistence, courage, initiative, may vary from zero upward without limit. Perhaps the most important dividing line—one that has already shown itself at various critical points—is that between the willingness to defend and the willingness to attack, between the defensive and the aggressive mentality.

But the readiness to wait, the negative element in morale, is as important as the readiness to act, and oftentimes it is harder virtue. Patience, especially under conditions of ignorance of what may be brewing, is a torment for active and critical minds such as this people is made of. Yet impetuousity, exceeding of orders, unwillingness to retreat when the general situation demands it, are signs not of good morale but the reverse.

However far the orders go, there is always the last touch that cannot be commanded, but can only be given. All the difference between effective and ineffective war-making lies in the success of government or command in enlisting this free contribution of the man to his defined duty.

We may then consider that, when we speak of a certain military organization as possessing *high morale,* we mean that its members, individually and collectively, have had induced in them a certain condition of mind that is highly necessary if they are to carry on military operations successfully; that they have been so trained that they are ready to give that "last touch that cannot be commanded, but can only be given"; that the superior command has from them succeeded in "enlisting this free contribution of the man to his defined duty." To induce this condition the commander must proceed in accordance with psychological principles; that is, high morale, being a desirable mental condition, is an end to be accomplished, and psychology teaches us the means by which to attain this end. Such being the case, every discussion of morale must in general be psychological in its nature.

Ship life is a life in itself, apart from anything else known in life, and as such it makes its imprint upon all minds that undergo it. Therefore, in considering the minds of naval personnel, we must remember that such minds have inevitably been influenced by environment, by the peculiarities not only of military, but of ship

life. To appeal to such minds as though they were what would be called normal in civil life would be an error—such minds are not normal according to civilian standards. It is in this particular that civilian officials most frequently err in their control of and dealings with naval personnel; and their failures are not only in an inability to properly fathom the workings of the naval mind, but generally in a complete failure to comprehend that such minds are vastly different from their own; or, worse yet, if they recognize that such differences exist, in a determination to disregard the peculiarities of the naval mind and to force it to conform to civilian standards—to their own. Such an effort as this last is bound to be disastrously unsuccessful. Hocking says that "a man's mental self cannot be separated from his daily habits, from the environment he lives in, from the kind of difficulties he is coping with, from the plans, ambitions, and ideas that he is occupied with." Whosoever attempts to run counter to this idea in dealing with naval personnel not only causes loss of morale, but attempts to change such a state of mind from that which is desirable to that which is undesirable—to disintegrate a desirable condition, one that has been built up by much study, effort, and time, into one that is entirely unsatisfactory for naval purposes.

In further considering the life of a man in the navy, there must always be borne in mind the loss of personal freedom inevitably incident to such life, a realization of which loss must always remain in some degree to affect a man's mentality, no matter to what degree years of contented and happy service may tend to diminish any sense of real loss from this cause. Therefore, as a step in creating morale, the effort must be to obliterate as far as possible this sense of loss, and to supply other desirable things that shall in a great measure compensate for it. That is, interest in the life and contentment must be supplied. Interest is generally aroused by ambition—personal ambition and ambition to achieve in the name of the service and of the country. Contentment follows just treatment, interesting life, comfortable life, work in quantity and character proper to cause the days to pass without *ennui*, and absence of disagreeable or excessive labor and of abnormal and uncomfortable living conditions. Under war conditions the elements of contentment, as enumerated above, in a large measure cannot be

supplied; and, under such circumstances, we must appeal to interest and ambition to make good the loss in other directions.

In the effort to build up morale in a body of men there is one very critical point in their development which should be regarded with the utmost attention—its place and character are epitomized in the old saying that "a little learning is a dangerous thing." In the discussion of *child psychology* attention was called to the fact that in the induction of recruits into naval life we have a problem somewhat similar to the education of a child; and it may with reason be said that the problem is also similar in character to the one that exists in the absorption in mass into our body politic of a group of ignorant immigrants. An entirely ignorant body of men may be ruled through fear, by playing upon their superstitions, or by the influence exerted over them by a commanding personality; but these means of control continue effective only so long as the individuals composing the group remain uneducated. Now it is against our national policy (if not our national practice) that any of our citizens or permanent residents shall remain uneducated, and so the education of a body of immigrants is supposed to begin as soon after they are admitted to the country as we can start it. The result of this first educational effort is that fear, superstition, and personal influence soon cease to give the power of control; each individual in the mass begins to crudely understand the things that go on around him—or to think that he understands them—and to think for himself; and, unfortunately, *of* himself exclusively. It is at this stage of development; so often seen in the history of immigration and of the negro race, and today very strongly in evidence in both cases; that danger to the commonwealth ensues. The power of control through fear, superstition, and pure personal influence has passed way, and instead we have what the individual concerned considers to be knowledge and thought, but what is in reality only false knowledge and wrong thought processes. It is upon this condition that the demagogue plays—personal influence of a kind, to be sure, but influence not based solely on the personality of the demagogue, but mainly upon the real ignorance but supposed knowledge of the victim. Through this relationship is made the appeal to faulty reasoning powers; through it the original fear of the ignorant is changed to

the anger and resentment of the half-informed; and then, in labor circles, we have the unreasonable strike to gain impossible ends, and with it violence. Through this stage of educational development man thinks of himself alone, and the danger from him continues until further education and broadening of the mind make him see that his own well-being is dependent upon that of the surrounding community. In this awakening there may or may not be an altruistic element—let us consider that there is not—but in any event, as soon as a man awakes to the fact that by helping the community in which he lives he helps himself, then the period of gravest danger is over so far as that individual is concerned. Whether his motives be selfish, altruistic, or both, his realization that he must support the organized society of which he is a member will make him consider well before he rebels against law or custom. In general, and this country is now suffering from this cause, this awakening first takes form in loyalty to some narrow element in the community—usually to his own particular labor union—wherein lies trouble if the leaders of that union be not alert, honest, and conservative. When the man sees that his first responsibility is not to himself; is not to any one class of society, as to a labor union; but to the community at large; he then becomes, according to his mental capacity, a real, reasoning being, capable of a sufficiently broad view of life to make him realize that present self-control and restraint, even though inspired by purely selfish motives, bring future benefits that are well worthy of present effort and sacrifice.

A somewhat similar phase is passed through by the naval recruit; when he enters the service he is controlled by a feeling that perhaps cannot properly be called fear, but better, a natural awe of his strange surroundings; which feeling makes him attempt to fall into step with what goes on around him. Instead of superstition we have in him a feeling that urges him to accept conditions, rules, and regulations as they are without seeking to question them; and the personal influence factor becomes not only that actually exerted by the individuals who directly control him, but an influence emanating not alone from an individual, officer or man, senior to him, but as well from its outward and visible sign of power and designating symbol—the uniform. As the recruit be-

comes somewhat accustomed to his life, after his naval education is well under way, there comes a time when he naturally begins to question everything. His feeling of awe and his lack of ease due to strange surroundings have departed and no longer exert a controlling influence upon him. He begins to look upon the rules, regulations, and customs of the service as being arbitrary and useless, for he is taking the narrow, half-educated view, and sees not the broad purpose for which such things exist. Regarding things in this light, he looks upon those who exercise personal control over him simply as representatives of a foolish and oppressive rule, and he sighs for the lost freedom of civil life. It is in this stage of development that the recruit becomes a source of danger, a prey to fomenters of indiscipline; in the old days a man ready to join in a mutiny, and today a man who does and must lower the morale of the unit to which he belongs. He must be carried through this stage safely and quickly, or else removed from the service; and fortunate is the organization which, by its educational methods, by its ruling personalities, and by its general morale makes this period short for the recruit and quickly teaches him to see that that against which he is now inclined to rebel is a necessary attribute to an efficient and contented military unit. That such is the case is shown by the fact that, if justness prevail on board, the taut ship is the happy ship and the efficient ship. There each man, having learned to look beyond his own immediate selfish impulse, has found out that in the happiness and efficiency of his community alone are to be found happiness and progress and development for himself. The conditions most favorable for passing a recruit quickly through this dangerous stage in his development depend upon two factors; first, upon his being a member of a contented, well-disciplined, and efficient organization; and, second, upon there being a small percentage of such recruits in the unit at the same time. Under these conditions the recruit, unless hopelessly bad, passes through the danger zone quickly and unconsciously, but when other conditions exist the morale of the whole is necessarily lowered by the presence of a large percentage of disgruntled, rebellious and half-trained men. Unfortunately when war breaks out we see a great mass of recruits coming into every organization, enough to swamp it under ordinary conditions and

certainly enough to materially lower its morale under any conditions; but fortunately, on the other hand, at such times we have present in practically every recruit ambition and desire to serve, and the presence of these feelings, together with the generally higher character of men brought in by the outbreak of war, enables us to work wonders even with such a mass of raw material.

To create high morale a commander must inspire those under him with a feeling of confidence in himself, in his knowledge, ability, strength of character, justness; in fact with a confidence that he possesses all the qualities that are discussed in this thesis as being requisite for command. For instance there is nothing that so helps the captain of a ship to inspire the officers and men under his command with a belief in him, nothing that so aids him to improve their morale, as the ability to handle the ship boldly and well, and the willingness to do it when occasion demands. And not only is the manner in which the ship herself is handled of importance, but as well the personal manner and bearing of the officer who does it. A well-handled ship, showing this most noticeable outward symptom of efficiency, inspires her personnel with an ambition to equal her efficiency in that particular in all others as well; it gives every officer and man a feeling of pride in her and a desire himself so to do his part that she may be as efficient in all functions in which he personally takes a part as she is in those directly controlled by the captain in person. While endeavoring to inspire the above feeling in regard to himself, a successful commander must at the same time inspire in his subordinates self-respect, confidence in themselves, ambition, a conscientious regard for duty, etc.

From this discussion it is apparent that in the mental condition that is indicated by the phrase *high morale*, there must be a certain *hard* quality. There can be no high morale in a soft organization, and it is reported of one of the Prussian generals of the earlier days that he always toughened a new regiment by firing into it with artillery and infantry—a truly Prussian proceeding, if the story be true. This exaggeration indicates a danger, however, and that danger is that in our efforts to attain comfort, contentment, and amusement for our personnel, we may ren-

der them soft by "coddling"them unduly—I believe that the Navy is today suffering from this fault to a very considerable degree. Many times within the last few years I have heard officers—not a few of them old enough to know better and to be ashamed of themselves—bewailing the hardship and bemoaning the effect upon morale of things that a few years before were matters of course. I have heard that being in Mexican waters for six months without liberty was a great hardship that it was a crime to impose upon men, and that the morale of the ship's company was low at the end as a result! I have heard that having to go without fresh meat, fresh potatoes, or what not of that kind, for a week, was an unendurable hardship! I have heard that the running out of the canteen stock and delay in receiving a new supply was a hardship! I have heard that not receiving a new supply of "movie" films from time to time was a hardship and exercised a deleterious effect upon morale! I have heard that being deprived of athletic opportunities by the exigencies of the service was a hardship and deleterious to morale! I might proceed with this list considerably further, and I cannot but wonder if these officers and men do not in some degree lack that hardness that is a necessary element in high morale. To a man who has seen the days when there was no canteen, when fresh provisions were available for officers and men in port only and even then were given to the men every other day at the most, when there were no amusements or athletics, when the personnel of a ship thought they were fortunate if their tour of "no liberty" duty in the West Indies or elsewhere was less than a year in length, when nothing but warm water came from the scuttle butt, when there were no ice machines, and when absence from home on foreign station (and families could not follow greatly in those days of long distances and difficult travel) for from three to four years was a common thing; a part of the day's work, so to speak; and not as now the exception; the question cannot but arise in my mind as to whether today we are not suffering from *softness* to a degree not a little detrimental to our morale.

Far be it from me to advocate a return to the old conditions in full—I believe in every possible effort to ameliorate the undoubtedly hard life of the naval personnel, and I know that when

great demands come, as they did in the last war, officers and men alike respond with alacrity and bear with equanimity and fortitude the conditions to which they are necessarily exposed. But is the spirit that does this so good, the morale so high, in a force that does this and pats itself on the back for so doing, as it was in a force that not only stood ready to do the same things in the same emergency, but that actually did many of them or worse, daily, in the routine performance of duty and without considering it anything outside the line of regular duty? Then there was little talk of a lowering of morale from these causes. This question is well worthy of serious consideration, and of such effort to change the feeling of today into that of yesterday as may be found practicable without the infliction of undue hardship.

To go into details in regard to all the methods of creating and maintaining morale; as to how best to attain the desired results; would reach far beyond all possible limits of a general thesis.

ESPRIT DE CORPS

Esprit de corps is a phrase formerly extensively used in speaking of the military and naval services or of individual units thereof, but of late years it appears to have become merged in the more comprehensive term *morale*. The dictionary definitions of the phrase are:

> *Esprit de Corps.*—The common spirit pervading the members of a body or association of persons. It implies sympathy, enthusiasm, devotion, and jealous regard for the honor of the body as a whole. (Webster's *New International Dictionary.*)
>
> *Esprit de Corps.*—A spirit of common devotedness, sympathy, or support among members of an association or body; comradeship. (Funk and Wagnall's *New Standard Dictionary.*)

From these definitions it will be seen that the now more widely used word *morale* includes all that could be included under the narrower phrase *esprit de corps,* for morale refers inherently to the entire body military under consideration, whereas *esprit de corps* may refer to the spirit within a part of such complete organization, literally, within any one particular *corps.* In one corps of the navy there may be high *esprit de corps,* and yet that feeling may tend to do anything but improve the service *morale,* as was the case in the days of the old line and engineer corps bad

feeling, which operated to lower service morale. Therefore we may say that *esprit de corps,* as the phrase was formerly employed, implies in a lesser and incomplete sense what we have more lately come to designate as *morale.*

LOYALTY

Loyalty is certainly a very great element in morale. The dictionaries give us as definitions of loyalty and of the necessarily accompanying word *loyal,* the following:

Loyalty.—State or quality of being loyal; fidelity to a superior, or to duty, love, etc.

Loyal.—Faithful to law; faithful and true to the lawful government, or to prince or sovereign to whom one is subject; unswerving in allegiance. (Webster's *New International Dictionary.*)

Loyalty.—The quality or state of being loyal; devoted allegiance to a government or chief; hearty service in friendship or love, or to a cause.

Loyal.—Constant and faithful in any relation implying trust or confidence, as wife to husband, friend to friend, etc.; bearing true allegiance to constituted authority; specifically, adhering to the constituted government in time of rebellion or revolution. (Funk and Wagnall's *New Standard Dictionary.*)

From these definitions we may with justice infer that we must seek to inspire in the personnel of the naval service loyalty to:

1. *Country,* which is patriotism.

2. *Duty,* in general, and in every case loyalty to one's mission. Such loyalty implies the possession of a high sense of duty.

3. *The Service,* which is *esprit de corps* in its broadest sense, the corps in question being the Navy as a whole and not any one of its component parts.

4. *Seniors in Command,* for unless such seniors command loyalty both to themselves and to their plans, whole-hearted and successful efforts cannot be expected from subordinates.

5. *Subordinates,* for unless an officer is loyal to his subordinates he cannot expect them to be loyal to him; a fact too often forgotten in the old days, when many officers of rank conceived that it must be sufficient honor and glory to serve on board *my* ship, no matter what might be *my* capabilities or character, nor what kind of treatment *my officers* and *my men* might receive from me. To secure loyalty from subordinates one must furnish something to which they can be loyal. It has been to the credit of the service

through many years that where the immediate superior has so failed to secure loyalty to his own person, the greater sense of loyalty to country, to service, and to duty on the part of officers and men has carried the Navy through.

6. *Self,* for if a man be not loyal to the best that is in him it is inherently impossible for him to be loyal to anyone or anything else.

We see from the above that in general we have to consider two forms of loyalty, the one, which is the greatest, being loyalty to a cause, to an idea, to a principle, and the other being loyalty to an individual. Of course apparent loyalty in either case may be inspired by selfish motives, but such loyalty is only superficial and is not real—it is not loyalty at all, but merely service rendered for pay received, promised, or hoped for, and need therefore receive little attention as a true element of loyalty. True loyalty to cause, idea, or principle is a matter of conscience and honor, and as such is the highest form. In history we see repeated cases of loyalty to prince or sovereign, inspired (neglecting the selfish considerations touched upon above) by affection for the person himself or for his personal cause. In some cases such loyalty to an individual has been coincident with loyalty to higher things—that depends upon the justice of the cause of such individual—whereas in others it has been directly opposed to all true loyalty to higher things. Such cases, when of important dimensions, have usually occurred in countries under the direct personal rule of an individual sovereign, and such loyalty is usually absent, except among a few personal adherents, in such a democracy as ours. No matter how much we of the naval service may admire the individual who may happen to be our president at any moment, it has never been and probably never will be possible for any holder of that high office to inspire in the service at large such a sense of personal loyalty to himself as an individual as would cause the service to hesitate for an instant between loyalty to the president as an individual and loyalty to the country and to the principles underlying our form of government. One reason for this is the fact that no naval officer has ever attained the position of president, and should one do so he will thereby vacate his position as a naval officer. Only an officer of years and rank could ever do this, and should it ever

happen it is probable that the service at large would look upon the individual concerned with lessened, rather than with increased respect and loyalty to him as an individual. As a result of all this the individuals composing the service have little personal knowledge of him who for the time being occupies the office of president, and the short tenure of office of the president and his many other pressing duties and demands upon his time prevent him, even should he so desire and even though he be the titular commander-in-chief of the Army and Navy, from gaining such intimate acquaintanceship with the officers of the service and from building up among them such personal influence as would substitute loyalty to his person for abstract loyalty to the country and to him impersonally in his capacity of chief representative of the people whom all serve alike.

Passing down the line from the President to his immediate subordinates, we find much the same conditions existing in regard to the Secretary of the Navy, for his personal acquaintanceship with and influence over the officers and men of the service must necessarily be slight. When we come to the senior naval officers, however, the situation is different. Here we have men who have a large acquaintanceship in the service; we know them personally and have formed our own estimates of their strength and weaknesses. Here there is an opportunity for such an officer to build up a personal following, and many such officers have had such a following, but to their credit it may truthfully be said that there is no case on record where any naval officer has knowingly or purposely employed such influences along lines detrimental to the interests of the country or of the service. Not only has this been true, but it is an undoubted fact that any such effort, had it been made, must inevitably have resulted in failure—the sense of loyalty to country has always been so strong in the rank and file of the service that any such effort would have promptly disintegrated all personal influence of the individual making it—the navy of the United States has never taken part in any *coup d'état*.

But loyalty to the individual on the part of the service, when properly used by its possessor, is a most important asset, not only to an officer in command who possesses it, but to the service and to the country. There is no greater upbuilder of morale in any

organization than a feeling of loyalty to its head, and, if this head use this sentiment patriotically and wisely, it becomes a distinct and very great asset to the service and to the country, and inspires the organization with a spirit and *élan* that can be aroused by no other feeling. Therefore, personal loyalty to a commander is an all important element, the attainment of which should be the effort of every officer; and, having gained it, he should use it for the betterment of his own immediate command and for the service of his country. No better example of great personal influence over subordinates gained by an officer and usefully employed by him in the service of his country can be found than is shown in every phase of the life of Lord Nelson.

MILITARY CHARACTER AS A FACTOR IN MORALE

Military character is later more fully discussed under the general heading of *character*, but it is here pertinent to speak of it without detailed analysis and merely as an element of morale. Morale cannot be created unless there be something upon which to build, something to which appeal can be successfully made. Character, both military and personal, furnishes such a foundation —if the character of the individual be high then the appeal can be successfully made; if it be low, little or no success will be attained. And it may justly be said that, from this particular angle, stability of character is a prime essential. No morale can be established upon a low character, but there are also many men not of low character who, although the appeal for high morale can be successfully made to them at first, lack the necessary hardness and stability, the requisite fortitude and other similar characteristics, to enable them to maintain the state of high morale towards which their environment, the influences exerted upon them, and, it may be, their own inclinations, tend to lead them and to which they may in truth personally aspire. The mercurial temperament, no matter how worthy may be the character that accompanies it, while it may be capable of being elevated for the moment to a state of exceedingly high morale, is nevertheless a very poor field to cultivate for the *maintenance* of that most necessary quality, for if the cultivation be remitted even for a moment, or if circumstances bring about temporary discouragement, the tares spring up and choke the wheat.

We are here discussing the creation and maintenance of high morale, and, as one element of it, of military character, and it may perhaps be doubted whether military character is in reality capable of being created by outside influences. Its creation can certainly be influenced by teaching and environment, however; and this statement predicates that the teaching and suitable environment shall exist in the days that are formative of character. The first element necessary for the development of proper military character is of course the existence of high personal character, which should necessarily be inculcated in the child before it ever comes within the jurisdiction of the naval authorities. At a certain time, however, and in many if not most cases, the individual is turned over to us before the formation of personal character is completed, and the first step to be taken by the naval authorities must be to guard what has been well done in the formation of personal character and to further develop it; meanwhile endeavoring to eradicate and neutralize that which is not good. Concurrently with this effort begins the attempt to create high military character; that is, to erect upon such foundation of good personal character as we may find, a structure of special construction; a structure based upon the peculiar requirements of military and naval life. Many elements enter into this, some of which might not be greatly missed in civil life; but even there, it may truthfully be said that there is no element of high military character that would not be a valuable asset to anyone in any walk in life, and not only to the individual himself but also quite as much to those with whom he is associated and those to whom he renders service.

KNOWLEDGE OF THE PRINCIPLES UNDERLYING CO-OPERATION

The question of co-operation is one mainly, if not entirely, of personnel—of one's relations with other individuals. Of course, to co-operate with others in the performance of any particular duty, as in the conduct of a campaign, one must know and have the ability to perform one's own part in it, and also how to so perform it that in all its parts it will fit in with the parts of others. This may perhaps be termed the mechanical aspect of the affair, and this may be well done and the result still not be perfect. To breathe life

into the movement, it—the common cause—must receive from each principal actor in it that "last touch that cannot be commanded, but can only be given;" that "free contribution of the man to his defined duty" of which Hocking speaks in his definition of *morale*.

Therefore co-operation rests upon both ability and zeal; on knowledge and power; and on the ability to act toward a common end together with others over some of whom at least one may have no direct control. To do this successfully loyalty to plan, to mission, and to duty are requisite, and the first requisite for this is *indoctrination*. *Indoctrination* means a knowledge of plan, not in the narrow sense of some particular plan, of certain written orders, of some particular campaign plans, etc., alone, but of the spirit and purpose underlying and inspiring the whole operation. In no work of magnitude, different details of which must be undertaken by subordinates not under the immediate control of the commander, can specific plans cover all contingencies; it is always the unexpected that happens; therefore indoctrination in principles is vitally necessary, for it is only through such indoctrination that widely separated officers can successfully act in unison in furtherance of a common purpose. Indoctrination thus furnishes the common basis for operation, and loyalty will then supply the moving spirit.

On their face these remarks apply to co-operative action between equals in command; to such cases as, on the one hand, the operations of allied forces not under a unified command; and, on the other, the movements of a number of flag officers of equal force and authority, as force or squadron commanders, serving perhaps under a common commander-in-chief, but carrying on detached operations in unison in the same general area. Such a case as the latter is that in which several scouting forces, with supports, are covering a certain area, under the general direction of the commander-in-chief, who is perhaps well to the rear with the main force. Nevertheless the same principles apply with force to such lesser situations, and even to officers under the more direct command of a common superior; as is the case with the heads of department on board ship—to make an efficient ship, these officers must supply the same spirit of co-operation among themselves,

even though the eye of the captain be immediately upon them. And the captain must co-operate with them also, otherwise their efforts cannot succeed.

In the last analysis the proper performance of duty by his subordinates will rest upon the actions of the commander-in-chief himself. Unless he adheres to the principles with which he has indoctrinated his subordinates, unless he himself acts in full loyalty to the purpose and mission to which he has formed the loyalty of his subordinates, he can expect little in the way of results except confusion. As a lesser example, a captain demands the co-operation of his heads of department, but they can do little or nothing to produce good results unless they receive the heartiest possible co-operation from captain *along the lines which he has himself laid down for them to follow;* action on his part eccentric to accepted principles and purposes will nullify all the benefits resulting from proper indoctrination.

And a most important feature of co-operation lies in what is commonly known as the *initiative of the subordinate;* that is, in the ability and the right of each subordinate, in the face of unforeseen conditions; to act upon his own initiative, according to general principles, and, under some circumstances, even in contravention to his existing specific orders, with a view to furthering to the utmost the broad purpose of the senior in command.

Co-operation therefore depends upon ability and strength to act, upon loyalty to commander and to purpose, upon thorough indoctrination, and upon the right and ability of the subordinate to act wisely on his own initiative when necessary. And accompanying this right of initiative must manifestly be a thorough pyschological understanding of those in conjunction with whom one is trying to work. In fact, when we say that a subordinate has been thoroughly indoctrinated by his commander-in-chief, we mean that he has been taught to think, in any sudden emergency, as the commander-in-chief himself would think were he there present; that is, the subordinate must mentally put himself in the place of the commander-in-chief and, knowing the general end in view, must decide what the comamnder-in-chief would order him to do were he cognizant of all the circumstances and in a position to issue an order covering them. The strength to exer-

cise initiative is of course a matter of character, but we see that the phase of such initiative that involves the preliminary decision as to what to do is in reality a matter of almost pure psychological reasoning; of deciding what someone else would do in the face of certain given conditions.

As co-operation rests upon a foundation the several elements of which have just been enumerated, so the building upon those elements becomes a case of personal co-operation; of co-ordinating within one's self the several elements involved, giving due weight to each, and finally the furnishing from one's own character of each of the necessary elements in due proportion.

KNOWLEDGE OF THE CHARACTER AND TEMPER OF NATIONS AND PEOPLES

The question of a necessity for an understanding by a high commander of the character and temper of nations and peoples has been touched upon in the discussion of psychology, but there are certain phases of this particular subject that makes it advisable to give it some consideration as a specific topic in itself. Primarily it may be said that, if operations of war are to be continuously successful, the military forces employed must be upheld by the people of the nation prosecuting them and of its allies. Therefore those charged with the conduct of such operations must understand such nations and peoples. Furthermore such operations must be so conducted as to most greatly oppress the adversary nation or nations and their peoples, from which it follows that it is necessary to understand them; for here we mean not only actual physical oppression, but such oppression as will weigh most heavily upon such adversaries mentally and morally, such as will most quickly reduce their morale and their will to resist. In planning a campaign the question must therefore be asked: "What operations will most encourage and be most strongly supported by our own and by our allied nations and peoples; and what will most depress and be most ineffectively opposed by hostile nations and peoples?" In deciding upon a plan of campaign, much weight must be given to the answer that we find in this question, and, together with the principles of strategy and even as a part of strategy, consideration of these points will lead to the final deter-

mination of a plan of campaign. It is partly the answers to this question that make the offensive the most advantageous form of campaign whenever our resources and other considerations permit us to take it. As local offensive action, if well conceived and well executed, raises the morale and courage of the unit that takes it, so an equally well conceived and executed general offensive raises the morale of the nation and people that stand behind it.

Therefore a thorough comprehension of this subject is of the utmost value to those who are called upon to plan and conduct military operations, and in acquiring such knowledge and understanding it is necessary to weigh justly and correctly the several elements that go to make up a nation. In the first place there is the ruler of the nation, who must be understood if possible, both personally and as to his power over his people. Then there is the hierarchy of officials, civil and military; then the two military services each as a whole, apart from the higher officers of each; although of course in a perfect organization these should be as one, still such is not always the case. Then there is the people of the nation as a whole, which is undoubtedly divided into several groups, several schools of thought. Which of these groups of thinkers will determine the actions of the nation as a whole? The question is one as to what the people think first as individuals, second in the several groups, and finally as a whole; that is as a nation; and upon an estimate of all these, not always correctly made and not always possible, will depend the failure or success of plans. Therefore it is evident that a correct appreciation of all such elements is necessary to the perfect planning and execution of wars and of campaigns. And it will be apparent also that we must not only justly appreciate all the elements in the case of our enemy, but that we must understand our own people and the peoples of allied nations in the same manner.

(To be concluded.)

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AN IDEAL NAVY SUPPLY DEPOT

By LIEUT. COMMANDER WALTER D. SHARP, (SC) U. S. Navy

The study of every element of the art of war has, of course, received a marked impetus from the recent world conflict and the results of this study are evidenced by the efforts to secure adequate and efficient fighting units, properly equipped bases, sufficient personnel, armor and armament.

The subject of logistics has, of course, received the attention its importance merits and the writer does not presume, even were he able to do so, to add anything of material value to the knowledge of logistics in its broad sense. He does feel that his war experience with the particular function of supplies for expedition units, his more or less intensive study of the very necessary part of the work his corps has to do and the absolute necessity to the very existence of a fleet or ship in commission, of a positive, logical and continuously operating scheme for furnishing the thousand and one items of supplies demanded by a ship in active service warrant him in submitting to the service the following paper.

By way of introduction it is but repetition to state that war is a business and every business to be successful requires a definite policy and plan of operation; therefore as the service of supply is a part, and a very necessary part of the business of war, some plan and a very definite plan of operation must be determined upon in advance of actual hostilities.

The writer, therefore, assumes as a condition a war in the Pacific and that the operating base will be San Francisco Bay. On this assumption he submits a definite plan worked out on the basis of the requirements of an active fleet operating from this bay as its base.

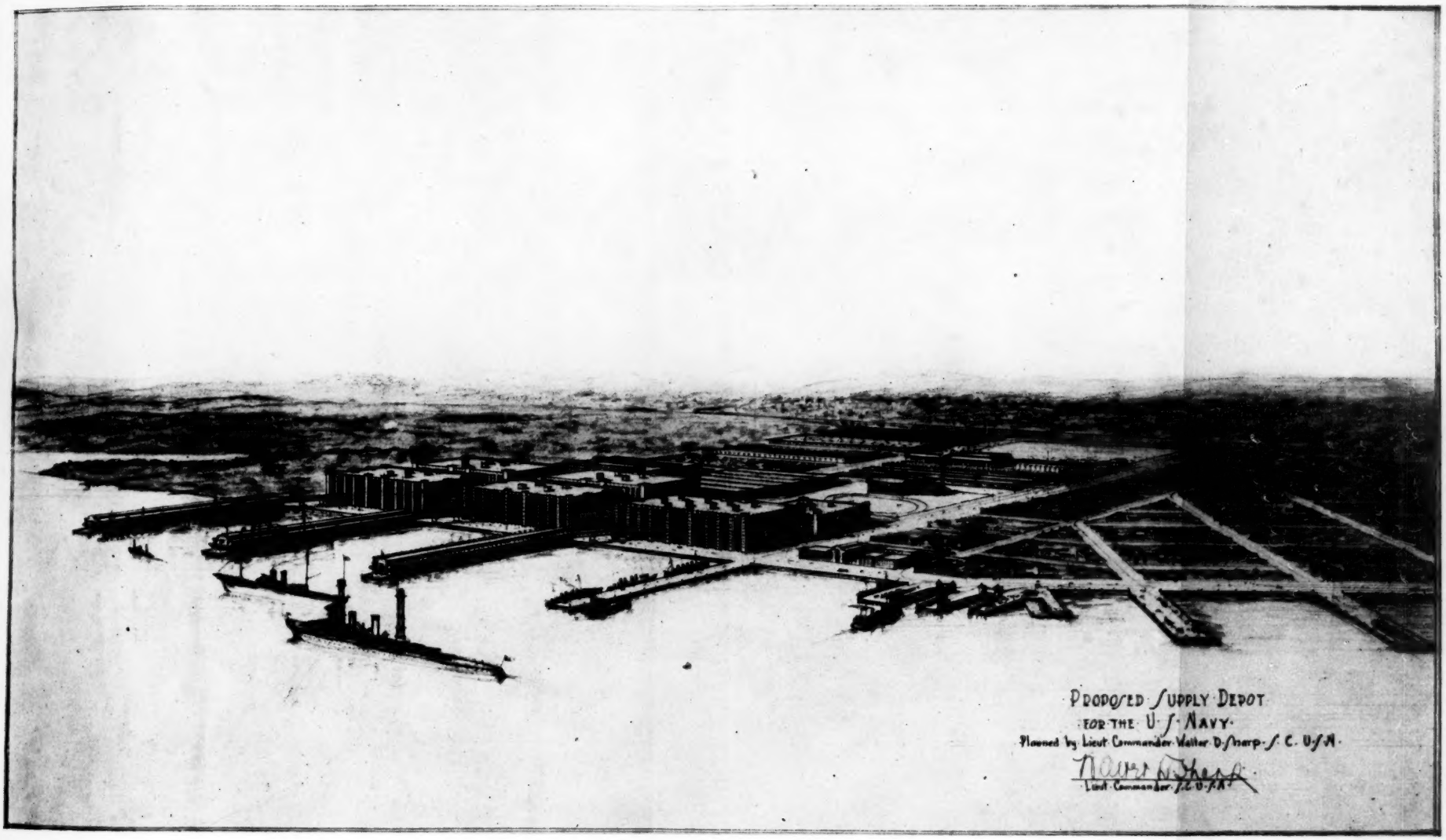
Now, without entering into any discussion as to the relative merits of any particular site within the limits of the bay, for all necessary facilities the writer will confine himself exclusively to the question of supply.

There is now at the Navy Yard, Mare Island, a Supply Department adequate for all industrial purposes and which is the only establishment of its kind in the vicinity supplying both the fleet and industrial units, but all officers agree that in the event of war it would not only be desirable, but rather a necessity, to establish some additional machinery for distributing supplies to the fleet, adjacent to the fleet anchorage, as well as to the best local market community, of course assuming proper railroad service and water front facilities.

To establish such a station after war has begun is not only attended by the confusion and rush of war conditions but involves an unnecessary expense and sacrifice of efficiency. Being familiar with the inception and execution of the same project at South Brooklyn and having had experience with its operation during a critical period I cannot escape the conviction that good business practice dictates as the only course to pursue provision for all facilities the necessity for which can be foreseen prior to the outbreak of hostilities. To formulate such a project requires, of course, an intimate knowledge of the demands, the sources of supply, the order of housing, with due regard to transportation facilities both water and rail, and the working organization necessary to handle it.

In preparing this plan I have assumed the area, the buildings and the water front, together with rail connections which I believe to be the minimum for the requirements.

While it is not the purpose of this paper to suggest a definite site for this depot, the suggestion is here made that there should be in the files of each district a broad, comprehensive and concise plan for such a depot, together with such additional information as may be available which may result in converting existing facilities to the purpose outlined herein. Besides this and of equal importance, until funds for the permanent building can be obtained, there should be prepared after careful investigation a confidential scheme for the utilization by commandeering of the best



Proposed Navy Supply Depot

adapted existing facilities under private or public ownership, the latter scheme for immediate use on the outbreak of war.

To one who struggled in the early days of the war under the stress of inadequate storage and handling facilities it is particularly disturbing to "sit in" on a conference met to formulate plans for a navy base and witness the inclusion in the report of the recommendation for "a storehouse." Indeed if we are to profit at all by the experience gained during the trying months of 1917-18 and '19 our ideas must broaden and supply depots must no longer be referred to as "a storehouse," but rather must we visualize a number of storehouses and buildings of divers dimensions and characteristics, as well as ample outdoor storage and water front facilities, all provided with up-to-date handling equipment and plenty of it.

Not only do we err in using the term "a storehouse" but also are we faulty in thinking of the word "storage" except as one of the following phases of the service of supply, for as a matter of fact there are three separate and distinct activities or movements involved in this problem; i. e., procurement or incoming, storage or caretaking and, by far the most important, dispatch or outgoing.

The primary function of a supply depot is to supply the fleet or any other naval activity which may call upon it, all other duties being subordinated to that end. The guiding maxim of the supply officer must, therefore, be "to deliver" and that without delay, and, whether the article is on his shelf or not, he must "get it" and "deliver." The requisitioner is not interested in any phase of the work except to "get" what he asks for, he being required only to furnish an accurate description of what is wanted. To accomplish this, therefore, it is necessary that a supply depot be so equipped as to make delivery in the shortest possible time and to this end the buildings must be designed and located with care in order that ample space and facilities are provided to permit of the greatest freedom of movement, both incoming and outgoing.

With the above in mind the writer has prepared a plan which, it is believed, comprises all of the buildings and spaces required, a general description of which, together with the necessary storage and handling equipment, is noted herein.

(A) GENERAL STOREHOUSE—10 floors. (1,844,000 square feet). For miscellaneous general supply account stock, such as flags, bunting, boat and ship fittings, engine room supplies, electrical supplies, radio outfits, instruments of precision, blocks, rigging, cordage, boat and ship utensils, canvas, furniture, dry goods, bathroom and toilet fixtures, lighting apparatus, gaskets, packing, rubber hose, books, musical instruments, athletic equipment, brooms, brushes, hand tools, hardware, bolts, rivets, nuts, washers, pipes, tubing, pipe fittings, stationery, office equipment, mess gear, galley equipment, etc., etc. The radio testing room will be located on the same floor with radio outfits.

On the roof of this building is located a shed or room for the storage of compasses, of material to render such instruments as free as possible from the danger of metallic influence.

On the first floor will be located the receiving spaces properly equipped with receiving and inspection equipment. In this building will also be located the chemical laboratory, which is one of the inspection activities.

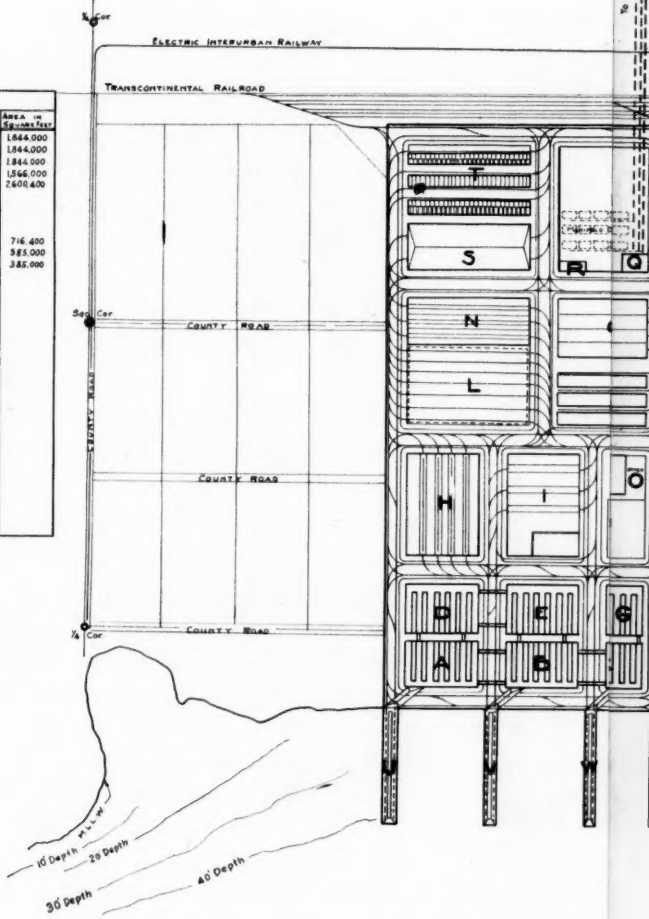
(B) GENERAL STOREHOUSE—10 floors, (1,844,000 square feet). On the roof of this building provision is made for equipment for testing range finders.

On the top floor is located the general administration offices, recreation and washrooms. On the remaining floors with the exception of the second and first floors, will be stored miscellaneous supplies and the library for the West Coast. On the second floor, in addition to storage, will be located the box making and packing sections, carpenters' and painters' shops, and on the first floor, in addition to the storage of heavy stock, such as bar and sheet metals, pipe cable, ingots, etc., space will be reserved for the dispatch and shipping assembly sections, as well as the electrical and machinery repair shops and charging boards for electric trucks. Additional charging boards will also be installed on other floors and in other buildings.

(C) PROVISIONS AND CLOTHING STOREHOUSE—10 floors, (1,884,000 square ft.) For storage of provisions and clothing and the clothing factory. Its general arrangement and equipment will be similar to A and B with modifications as may be required by the clothing factory.

KEY TO BUILDINGS

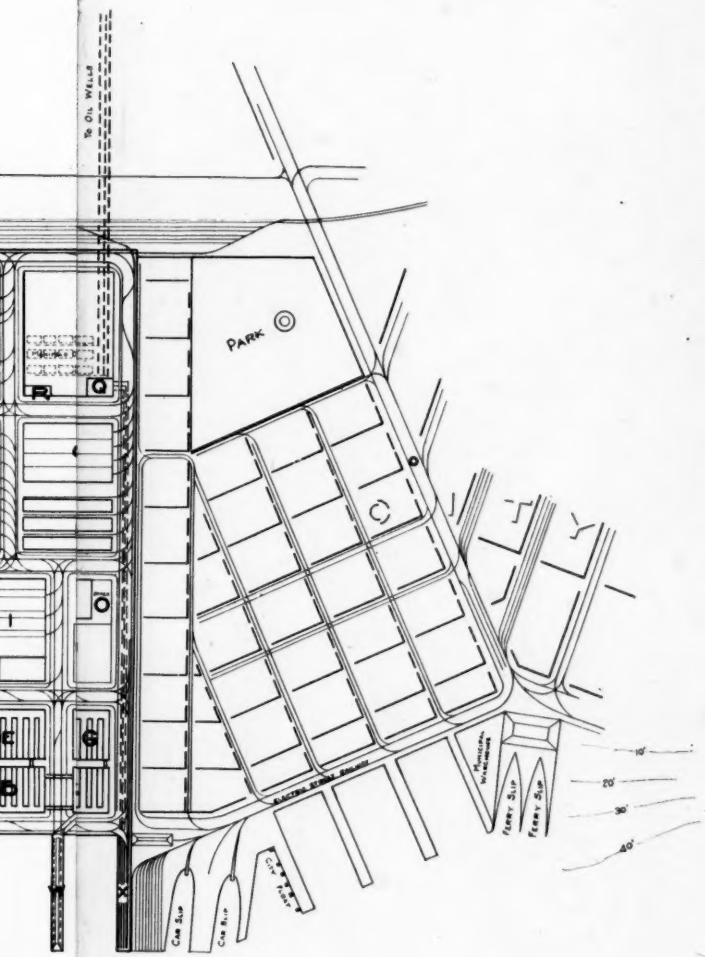
GROUP	USE	SIZE	AREA IN SQUARE FEET
A	General Storehouse	10 Floor	1,844,000
B	do. do.	10 do.	1,844,000
C	Provisions and Clothing Storehouse	10 do.	1,844,000
D	Ordnance Storehouse	6 do.	1,566,000
E	Special Storehouse	10 do.	2,600,400
	Ships Peace and Spare Equipment		
	Ships Outfitting		
	Salvage		
F	Coffee Roasting Plant	Special	
G	Cold Storage Building		716,400
H	Machinery Storehouse	1 Floor	385,000
I	Paint and Oil Storehouse	1 do.	385,000
J	Miscellaneous Outside Storage		
K	Power Plant		
L	Plate Racks		
M	Anchor Chain and Shafting Platforms		
N	Sheds for Building Materials		
O	Lumber Sheds	Modern	
P	Fuel Oil		
Q	Oil Pumping Station		
R	Gasoline Drum Filling and Storage House		
S	Boat Storage Shed	Modern	
T	Bins for Sand, Gravel, Coke and Scrap Metal		
U.V.W	Covered Double Decked Piers		
X	Uncovered Pier equipped with Fuel Oil Filling Pipes		



Scale 1" = 500

1000 500 0 500 1000 1500 2000 2500 3000 3500 4000 500

PROPOSED NAVY [illegible]PLY



PROPOSED NAVY SUPPLY DEPOT
FOR UNITED STATES NAVY

Lieut Commander (Supply Corps) U.S. Navy

PLANNED BY
LIEUT COMMANDER WALTER D. SHARP SUPPLY CORPS U S NAVY
MARCH 8 1921

(D) ORDNANCE STOREHOUSE—6 floors, (1,566,000 square feet). Especially designed with overhead cranes and heavy load elevators for the handling of torpedoes, guns, gun mounts, etc.

(E) SPECIAL STOREHOUSE—10 floors, (2,600,400 sq. ft.) This building is intended to serve the following purposes, the space being assigned as the needs of each require.

SHIP'S PEACE AND SPARE EQUIPMENT—The floors reserved for this purpose will be fitted with cages and lockers in which ships may store spare equipment and for landing "peace equipment" when stripping for battle. Such lockers will enable the ships to continue to carry this equipment on their books and withdraw the same at will.

SHIP'S OUTFITTING—The floors reserved for this purpose will be caged for the assembling of ships' outfits and supplies before commissioning.

SALVAGE—The floors reserved for this purpose will be utilized in the receipt, segregation, survey, reconditioning, sale or other disposition of all used material received from whatever source.

This function assumed large proportions during and immediately following the recent war. In August, 1918, the writer, foreseeing the need of an organization and facilities for handling the enormous quantities of material which would be "turned in" by ships of all classes, training camps and other local war time units, as well as the stations abroad, endeavored to interest the Department in the establishment of such an organization but without result. The question was again brought up in the summer of 1919 and was approved, but not, however, until the greater volume of material had been received. This placed a great strain on the Supply Departments which were bending every effort to outfit and supply the transports, with the result that the receipt, care, reconditioning and disposition of the material did not receive the attention it deserved. The fact that the object to be attained differs from that by a Supply Department emphasizes the necessity for a separate department for salvage purposes. Though the strain of the receipt of such

material was greatly relieved by the time the Salvage Department to which I refer, began to function, the results, coupled with the great reduction in the operating charges, amply justified its existence.

(F) COFFEE ROASTING PLANT—Specially constructed to suit the needs of the service in roasting and supplying coffee.

(G) COLD STORAGE PLANT—(716,400 square ft.) This building to be of modern construction and fitted for the receipt, inspection, freezing and preservation of fresh provisions.

(H) MACHINERY STOREHOUSE—1 floor and mezzanine, (585,000 square feet). This building is intended for the storage of construction and repair and engineering machinery, pumps and boiler and condenser tubes, etc.

(I) PAINT AND OIL STOREHOUSE—1 floor and mezzanine, (558,000 square feet). For the storage of oils, paints, soaps, asbestos, fire brick, etc., with one section separated by fire walls for acids. The sections reserved for the storage of oils to have floors graded and floor drains to permit of flushing.

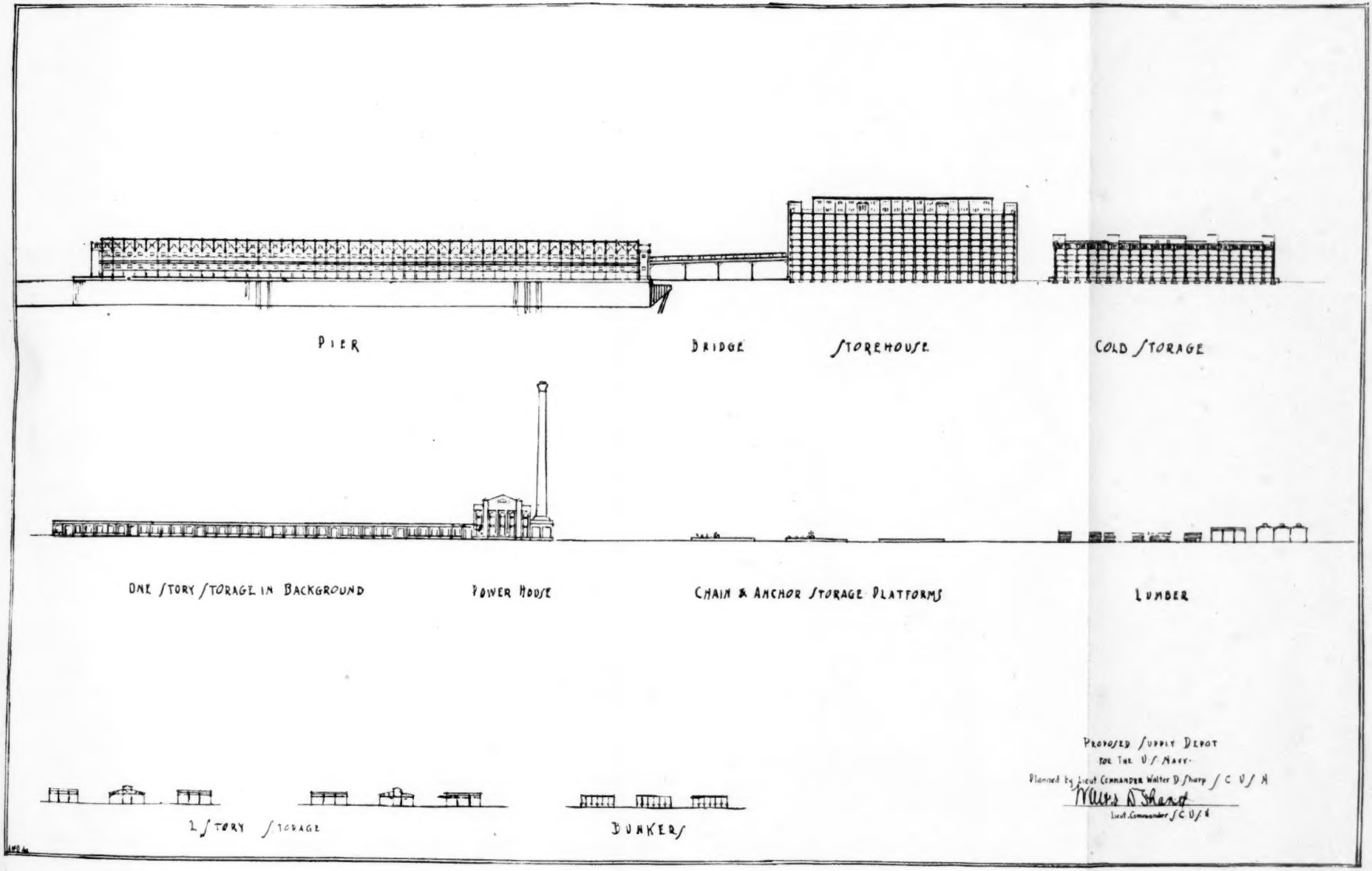
(J) MISCELLANEOUS OUTSIDE STORAGE—For life rafts, condemned boats and other miscellaneous material which will not be damaged by exposure. This lot will also serve as a "catch all," a necessary adjunct to any Supply Depot.

(K) POWER PLANT—Adequate to supply all power required by this depot. In the basement of this building will be located an incinerator for burning waste, etc.

(L) RACKS—For miscellaneous metal plates and shapes, used largely for construction purposes.

(M) PLATFORMS—For anchors, chain and shafting, with rests for anchor stocks.

(N) SHEDS AND OPEN AIR STORAGE—For lime, cement, sub-soil pipe, etc., brick, rails and rail connections, piles and other material usually required by the Public Works Department. The writer knows of no station where public works material is not scattered all over the yard in whatever space may be available for the moment, first here and then there, with added cost as a result.



PROPOSED NAVY SUPPLY DEPOT

(O) LUMBER SHEDS—Sheds and outdoor spaces for the storage of lumber. These sheds to be after modern design.

(P) FUEL OIL. In this section will be located the fuel oil pipe lines manifold pits connecting the several "farms" in San Francisco Bay with this depot and from which, in case of necessity, lines may be run to the oil wells of California.

(Q) In the space assigned for the manifold pits will also be located the Sub-Power Station for pumping oil to the ships' sides. This section may also be used as the depot "farm" for miscellaneous outdoor storage.

(R) For underground gasoline storage and facilities for filling drums for issue.

(S) BOAT STORAGE SHEDS, of modern design.

(T) BINS—For sand, gravel, coke, and scrap metals with magnets, metal saws, etc., for handling and breaking up scrap metal.

(U V W) PIERS—To be of double deck construction with elevators and connected with the main buildings by covered runways to permit of loading and unloading vessels without recourse to the use of automobile trucks. This permits of material being taken from the shelves, placed on the electric floor trucks and trailers and placed alongside the ship with a material saving in cost of delivery over the present method.

(X) UNCOVERED PIER—Equipped for filling the fuel oil tanks of vessels, etc., and for other purposes.

Speaking generally the equipment for handling material economically and expeditiously is of equal if not greater importance than storage and may be described as follows: The main buildings to be connected by covered bridges, ample railroad trackage connecting all groups and piers; locomotive cranes, overhead cranes; electric trucks; spiral chutes; elevators; racks; bins; shelving; cages; special inspection equipment; dark rooms for rubber; metal saws; box making machines; cross cut saws; planes and wood turning equipment; reel stands; cable measuring machines; lockers; locker rooms; washrooms; lavatories; recreation rooms; lunch rooms; etc.; and all floors to be fitted with fire sprinkling apparatus and signal equipment.

In order to picture the ease with which a vessel may be supplied by this depot, if equipped as outlined above, one has but to visualize a ship lying alongside one of the piers. A requisition for 2,000 sacks of flour has been received by the supply officer and he has touched the button which will put in operation the machinery for making delivery. The stockmen receiving his instructions "break out" the sacks, located on one of the upper floors of the provisions storehouse, drop them to the second floor by means of spiral chutes where they are loaded on trailers which are picked up by an electric truck, operated by one man, hauled over the runway to the upper deck of the pier and placed alongside the ship, where they are received, carried or hoisted on board and stowed.

In the case of lumber, anchors, chain, etc., flat cars will be placed alongside the sheds or platforms, loaded and hauled to the lower deck of the pier alongside the ship, where the material will be hoisted aboard by means of the pier or ship's equipment.

No provision has been made for special technical material required for the aeronautic service, it being understood that store houses for such will be located at the air stations.

It will also be noted that no reference has been made to a coaling plant which is of course a necessary unit of every supply group. Such was purposely omitted as there is already in San Francisco Bay a plant sufficient to care for present needs and susceptible of reasonable expansion. It is not believed that an additional plant will be necessary in view of the gradual decrease in the number of coal burning ships.

[COPYRIGHTED]

U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

A NOTE ON OFF-SHORE POSITIONS AS DETERMINED BY SEXTANT ALTITUDES OF DISTANT MOUNTAIN PEAKS

By COMMANDER J. L. SCHUYLER, U. S. Navy

1. On the Pacific coast—unlike in most other parts of the world—it is very often possible to see known mountain peaks beyond the horizon. And without tables—but using the following simple work form, distances are obtainable, which, there seems reason to believe, may often be rather more accurate than those which ordinary navigational sights would give.

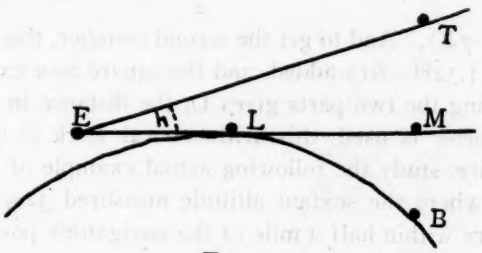


FIG. 1

2. The above is an exaggerated figure where E is the position of the eye, T the top and B the bottom of a peak H feet high and D miles distant. Assuming the eye 46 feet above the sea, the horizon at L is 7.8 miles distant (Table VI, Bowditch). The line tangent to the horizon at L cuts the peak at the point M, so that only the top part TM is exposed to view. Hence in measuring the altitude as 0 minutes, we are setting the angle where tangent is $\frac{TM}{6080D}$

3. The distance from M to L (in miles) equals $1.15\sqrt{MB}$ (from a formula given page 346 Bowditch 1905). Since ML is (D-7.8) we can write $\left\{\frac{D-7.8}{1.15}\right\}^2$ for MB.

Then $\frac{TM}{6080D} = \frac{H-MB}{6080D} = \text{Tan TEM}$ I

Or $\frac{H-\left\{\frac{D-7.8}{1.15}\right\}^2}{D6080} = b \times \text{Tan } 1^2$ II

4. Clearing this as an equation in D,

$O=D^2+D\,(2.34h-15.6)+(61-1.32H)$ III

and the desired root of this $D = \frac{-b}{2} + \frac{1}{2}\sqrt{b^2-4C}$

or $-\frac{b}{2} + \sqrt{\left(\frac{b}{2}\right)^2 - C}$ IV

where b is the coefficient of D and C is the independent term in equation III.

5. The first part of this,— $\frac{b}{2}$ is (from III), simply —(1.17h—7.8). And to get the second member, this need only be squared, (1.32H—61) added, and the square root extracted.

Combining the two parts gives D, the distance in miles and, if the omnimeter is used, this arithmetrical work is quickly done. For instance, study the following actual example of a peak 3,950 feet high where the sextant altitude measured 32.5 minutes and results were within half a mile of the navigator's position as fixed by the ordinary sights.

(Form for height of eye 46 feet.)

h (minutes).. 32.5...× 1.17 = 38.1	
— 7.8	— 61
(A) = 30.3	$(A)^2$ — 918
	1.32H = 5210
H (in feet) = 3950	
(B) = 77.9	$(B)^2$ = 6067
(B)—(A) = D (Distance in miles) = 47.6	

6. A 100-foot error in this mountain height throws one out only .9 of a mile and errors of one minute in altitude affect the position only .4 miles, or .4 times as much as a corresponding error in a sight. So even if one does not care to use it, it is perhaps interesting to see that such work is rather more accurate than one would at first suspect.

DISCUSSION

Officers for Shore Duty Only

(See Page 1885, Whole No. 226)

Captain Elliot Snow, (CC.) U. S. Navy.—The article contributed to the December number of the Proceedings on the subject "Officers for Shore Duty Only" is so unfair in its statements concerning the construction corps as a whole that I, as one of the corps, am impelled to make this refutation. Wherever the article touches the construction corps, whether it be upon its ideals, its methods of realizing those ideals, or its achievements, the writer displays much ignorance. If this be not soon pointed out, the article will have conveyed a lasting wrong impression to the uninitiated layman outside the service and to many officers in it. Thereby, the author presumably unwittingly will have perpetrated a great injustice to the members of that corps.

The author's opening sentences aroused high hopes as regards his article, but it was a sad disappointment to find it largely made up of generalities, with a large admixture of very inaccurate statements.

The subject is one that has been discussed by naval officers in one form or another ever since we had a navy, and doubtless its discussion will continue as long as we have a navy. It, however, comprises a question that is too large and involved to permit here a full discussion, so I shall restrict myself to specific points.

It is difficult to understand just what the author has in mind in many places. For instance, after a brief description of the present method of obtaining and handling specialists, the author says:

> It does not appear to the writer that such procedure can, with the wildest stretch of the imagination, be expected to produce the kind of specialists which the navy is in need of. There would appear to be two basic reasons for this: (a) The navy is approximately seventy-five per cent an operative and twenty-five per cent a building and repair problem. (b) Specialists who depend upon their work for a livelihood, and the monetary return from whose efforts fluctuates with their ability to please their clients with their work, are usually amenable to a suggestion from those who have to operate the product of their especial training; in other words, they meet the conditions imposed by their clients as far as it is possible to meet them.

The cryptic utterance (b) above is not again referred to nor further explained. I assume that it is intended to convey one of two ideas, either that navy specialists are too amenable to the operative side, or that they are not sufficiently so amenable. I have been unable to decide which one was intended.

The author's statement that:

. . . the construction corps of the navy seems honestly to believe that a constructor can learn little by recurring tours of sea duty.

seems worthy of comment. While I cannot speak for the whole construction corps, I do not believe that their attitude is quite that ascribed to them by the author. By recurring tours of sea duty, any constructor would learn much; the value of sea experience has never been minimized or belittled by the constructors. Unfortunately they have been confronted by a condition—not a theory. During practically my whole experience in the construction corps it has been woefully shorthanded, and it has been necessary to keep virtually all of them on shore duty. The work to be done there must be taken care of. Conditions are changing and apparently it will soon be possible for many more constructors to get experience at sea.

I do not agree with the author, however, in his line of argument, that the main value of sending such officers to sea would be to strengthen recommendations from ships for changes and improvements and thus give them a better chance of getting by. The author seems to share the impression of some other officers, I hope a small minority, that the construction corps knows little and cares less about the comfort of those who go down to the sea in ships.

The question of alterations of and improvements to ships is perennially with us. It is not a very live one at present, since, owing to short appropriations, general orders forbid changes not absolutely necessary for military or sanitary reasons. If the author will study or even carefully read chapter fifty-one of the current *Navy Regulations*—"Repairs and Alterations to Ships"—he will find that *a chief of bureau cannot disapprove an alteration*. An alteration disapproved by the Board of Inspection and Survey is practically dead and need not even be carried to the estimate stage. This board is required normally to pass upon alterations, and, as is well known, it is composed mainly of seagoing officers. Delays in acting upon recommended alterations are principally due to the requirement that the board must pass upon them as a regular routine.

Action upon alterations recommended by the Board of Inspection and Survey must be taken—not by the bureau concerned—but by higher authority. In practice, certain recommendations for alterations, mostly minor, that are not passed upon by the Board of Inspection and Survey, reach the bureaus. *These can be approved by the bureau concerned, but cannot be disapproved except by higher authority.*

As regards alterations desired by a ship, I rather think, taking things as they are and not as the author supposes them to be, that the presence of a naval constructor on a ship would not have the effect conceived by the author.

The author must have had some sad experience with ventilation, aboard ship, but his statement that "The ventilation as installed does not do what the calculations stated it would do," is a sweeping one as he apparently

intends it to apply to all ships. Nearly twenty years ago the Bureau of Construction and Repair reduced the question of ventilation to a more scientific basis, and eliminated the former rule-of-thumb methods. Now ventilation systems when designed are made the subject of careful advance calculations. The ventilating systems as installed are actually tested on new ships, and it is a matter of record that they do deliver air in close agreement with the calculations. It is not the practice to ignore results as the author seems to think.

If a ventilation system under service conditions delivers a volume of air that is materially less than on test, the condition can be due to but one of two reasons: either the ducts were not kept clear of rubbish or the system was not operated properly.

On pages 1888-9 the author makes a number of sweeping statements as regards things which are wrong in the army and navy. These he apparently ascribes to the fact that work was handled by a corps, or by what he regards as the equivalent of a corps. For instance, with reference to the condition of naval ordnance prior to 1899, he says:

> It will be found that our naval ordnance was of such flimsy construction and so inaccurately built as to make it almost useless.

This is a very sweeping statement and surely must be exaggerated. At any rate the service at the time certainly did not believe that any such condition existed. The author states that he is:

> . . . convinced that the method pursued by the Ordnance Bureau during the years immediately prior to the Spanish war made what was practically a corps out of the bureau and its activities, in that the bureau became a self-perpetuating body with a permanent head, with the result that it had all the mystery and obstruction of the other corps; and this mystery and obstruction retarded naval ordnance evolution immeasurably.

A little later on he speaks of officers in the Bureau of Ordnance being

> . . . returned each recurring shore duty to their old positions in the bureau, and who, through the peculiar kind of loyalty they thought they owed to ordnance, whose chief had been a fixture for twelve years or so, had that much incentive to be intolerant of suggestion from those who had not the inspiration which exists in the atmosphere surrounding the chief of the corps.

Here, as in many other places throughout the articles, the author's statements appear to bear but little relation to the facts. For instance, there never was a chief of bureau of ordnance who served twelve years; and during the years immediately prior to the Spanish war there was absolutely nothing resembling a permanent head in the Bureau of Ordnance. It was headed by Commodore Folger from February 12, 1890, to January 2, 1893—about three years; followed by Commodore Sampson, later the commander-in-chief during the Spanish war, from January 28, 1893, to May 31, 1897—a little over four years; and then by Charles O'Neil from June, 1897, to March, 1904. The author apparently regards 1899 as the end of the old régime. Up to that time Admiral O'Neil had held office but two years.

The author appears to claim that, except for the corps system, improvements made ultimately would have been made years before. Of course this is an opinion and not a demonstrable fact. It would be interesting to know in more detail various alleged facts upon which the author's opinion is based. For instance, on page 1889 he alleges that:

> . . . we had been likewise for years gravely calculating the necessary horsepower to drive hulls at a given speed only to find when we actually drove the hull at the designed speed that the horsepower necessary bore no relation to that we had calculated.

It is not clear to just what period of time this refers. The author appears to admit that naval ordnance and naval engineering saw the light in 1899, but that naval construction apparently has not yet seen it. Certainly, however, during the last twenty years when model basin facilities have been available for horsepower estimates, there has been no case of a naval vessel where the horsepower estimated bore no relation to that on trial. It would be interesting if the author would be specific as regards this allegation; giving the names of the vessels he has in mind, stating their designed and actual horsepower, and the proportion of these vessels to the total number built. In spite of the fact that our methods for estimating horsepower are more accurate than those of thirty years ago, it is believed that the author's statement, which would seem intended to apply to all naval vessels, is, to put it mildly, a gross exaggeration.

Further, on page 1895 the author says:

> . . . it might be stated that it is exceedingly probable that had the first-class ships of the navy each had a naval constructor attached to it, the improvement in stream lines of battleships would have been made very much earlier than was the case, as they would have had daily and practical demonstration of the remarkably inefficient stream lines of all our battleships up to the evolution of the dreadnought.

The alleged demonstration of the inefficient lines of our battleships could only appear when the vessels were steaming at or near full speed, so that the author's claim that "they would have had practical demonstrations daily" is obviously grotesquely in error. I doubt if under the circumstances of twenty-odd years ago, any demonstration in this connection occurred once in fifty days. Moreover, even if there had been daily demonstrations, the constructor attached to the ship, as a rule, would never have seen anything not already perfectly well known to the naval constructors responsible for the design.

When a new type of ship was tried, careful observations and records were made of the wave disturbance created, and in most cases, in addition to the trial board, officers attached to the design branch of the Bureau of Construction and Repair witnessed the trials for the purpose of studying these very matters under the most favorable conditions.

The author's opinion that the stream lines of all our battleships up to the dreadnought were remarkably inefficient is not warranted by the facts. Our early battleships were not required to make high speeds, and hence were made as short as possible; this resulted in a good deal of wave dis-

turbance at top speed. As top speeds increased with the approach of the dreadnought era, the vessels were made longer and the lines were made finer, and the results of careful model basin experiments which were available after 1900, were used to improve their forms. The author has, evidently, not grasped the fundamentals of resistance and propulsion and yet he presumes to criticize. If he would take the time to look up this question, he would discover the well-known fact that the primary requirement in connection with high speed of ships is an adequate length appropriate to the speed, and that while of course the form does affect the resistance, the practicable variations due to form are comparatively minor compared with those due to length. For instance, when the *Chester* and class were designed, about 1904, it was found that for a given displacement, and very high speed, the horsepower required for a length of 450 feet would be less than one-half that required if the vessel were made but 350 feet long.

If he proceeded a little further into the realm of the specialist, the author would discover, strange as it may seem, that as regards the vessels which he considers have remarkably inefficient stream lines and which pushed ahead "water which was only too anxious to get by," it might have been a mistake to adopt greater length resulting in easier driving form. There would be some saving in horsepower at top speed, but length is undesirable from every other point of view. Increase in length means more weight of hull, more weight for protection, and more power at cruising speed. More power at cruising speed means more fuel to be carried for endurance at cruising speed.

The mere fact that at maximum speed and over a range of but a knot or so, a battleship makes a strong bow wave, does not necessarily justify the conclusion that the specialist did not know what he was doing and would have prepared a different design if he had had a three years' cruise upon some other ship.

Some years ago American destroyers were making their speeds with about two-thirds of the power of contemporary British destroyers of about equivalent size and speed.

This, however, did not show that the British constructors were in error in adopting what the author would undoubtedly call "inefficient stream lines." At that time the British engineers were developing a horsepower on much less weight than we were. Getting their horsepower so cheaply as regards weight, it was justifiable to adopt decidedly shorter boats with the many attendant advantages and to accept for top speed the high resistance, necessarily incident to reduced length. Even to this day the British destroyers, all things considered, are relatively shorter than ours.

Thus far, I have restricted my comment to those statements of the author concerning matters about which I have personal knowledge and ready access to the facts. It is evident to me, as regards these matters, that his article may be correctly characterized as full of inaccuracies. The

author's onslaught upon other branches of the navy is possibly based upon more accurate knowledge than has been shown to be the case for the remainder of his article. It may develop, however, that these and the sweeping animadversions upon branches of our sister service, are also based solely upon personal opinion or gossip unsupported by facts.

The statement that the ordnance corps of the army, for instance,

> . . . designed and built the guns and mounts with practically no attention to suggestion from artilleriests of long experience; . . . and as a crowning achievement accomplished the feat of so redesigning the French 75, which had stood the test of four years of war, as to prevent the arrival of a single battery of American built 75s at the front before the Armistice.

is obviously one that should not be made unless the author knows of his own knowledge that it is correct. The army and the navy have suffered in the past, and seem likely to suffer still more in the immediate future, from circulation by people outside the service, of grossly erroneous statements and unwarranted attacks. Any such allegation coming from an officer of either service, is liable to be taken up, exaggerated, and circulated as being unimpeachably correct.

At the end of his paper the author, having devoted a number of pages to the question of shore duty, his nominal subject, winds up with a bald statement that naval constructors should be amalgamated and recites eight reasons for this view. His underlying idea appears to be that the corps of naval constructors can get no sea experience unless they are amalgamated with the line. But the majority of the eight reasons given for amalgamation have no real bearing on this line of thought. Already there are several corps of specialists—who do sea duty regularly, and there is nothing in the law to prevent the construction corps also from being thus detailed.

As I stated in the beginning, this is too large a question to discuss in detail in connection with this paper. It seems to me inevitable that if there be amalgamation with the line, and line officers do the work now done by the corps of naval constructors the end would be similar to that which obtained when the line officers did the work of naval ordnance prior to 1899. In other words, they would alternate with sea duty and naval construction duty on shore.

The author states that prior to 1899 (the date of amalgamation) "our engineering departments on board ship were in a deplorable condition." However, he does not discuss the present condition of our ships as regards engineering. There are many seagoing officers who consider the present conditions as distinctly susceptible of improvement. The thought occurs to me that assuming present engineering material conditions and the existence of a separate engineer corps, as in 1899, would there not be a much better chance of improvement if outspoken constructive criticism and insistent demands for improvement were made by operating officers? True, there would be more friction, but any motion involves friction. Only the quiescence of rest is frictionless.

I desire, in conclusion, to call attention to one point which is seldom brought out in discussions of amalgamation. As a fundamental question of organization, is it at all wise or even desirable that those who operate should be the same people who design and build? The product operated must of course be in the end satisfactory to the operators. Is there not some advantage in having the designers and builders segregated to some extent from the operators, even to the point of a certain lack of sympathy with resulting friction? We then insure that the operator is a fearless and unbiased critic of the product of the designer and builder. The designer and the builder in turn, if he keeps the open mind that he should, cannot help but profit from constructive criticism temperately offered. This attitude clearly insures the early detection of, and insistence upon, the correction of errors and shortcomings. Let us suppose, for instance, under the author's system, that an officer designs a ship, superintends its construction, and then commands her in service. This appears to be quite possible under the author's contemplated amalgamation. Human nature is one factor which is unchangeable in this world, and certainly this human characteristic would result in the commanding officer of that ship being "to her faults a little blind, to her virtues ever kind." Is that a desirable situation?

The article closes with this statement:

> It follows that the abolishment of "for shore duty only" among constructors and engineers is an essential to increasing service efficiency and, while it will undoubtedly be opposed by some, *the service would do well to look with care at the true reason for such opposition.*

The warning given implies that opposition to amalgamation may be made from unworthy motives. Evidently the author does not realize that there are good and sufficient reasons against this step. There is a subtle confusion of ideas introduced by the author throughout the article and an uncritical reader might easily be led to believe that the abolishment of "for shore duty only" is the same as "amalgamation." They are in no sense the same nor even equivalent.

Amalgamation of the construction corps with the line will violate a fundamental principle of organization as it means the complete coalescence of two corps whose lines of training, thought and life work are radically different. Although they strive toward a common end—the defense of the nation.

It will strongly tend to stifle all honest criticism of the construction materiel of the navy.

It will pave the way to a complete disorganization of the industrial branch of the navy at the outbreak of war.

Practical Lessons for American Navy

(SEE PAGE 1877, NO. 226)

CAPTAIN B. C. DECKER, U. S. N.—In the December number, there appears on page 1882 this remark, "That no commander could be justified in entering a known torpedo area with capital ships is certain." This is given in an article on "Practical Lessons for the American Navy." On page 1859

there appear Farragut's famous words "Damn the torpedoes! Go ahead!" Words that are "treasured and carried along to remind us what stuff our predecessors were made of."

The lesson set forth does not say more than that a known torpedo area is to be avoided, so that we can reasonably conclude that our imagination is to place torpedoes wherever they might have been fired and avoid the area. This would naturally lead to an indecisive action since at any time a fleet could fire torpedoes and run away.

But why avoid a torpedo area? Is it because of possible injury to ships? We cannot expect to win a fight without receiving injuries, the point to be decided will be the value of the objective. Farragut expected to lose some ships but counted on having enough left to accomplish his mission.

If we consider the Battle of Jutland we might be tempted to state the lesson in such a manner as to keep out of gun range, since three battle cruisers were sunk by gun fire, while the number of battleships injured by torpedoes was less. Though we know the English battle fleet passed many torpedoes, or were passed by torpedoes, only one was injured, but the result was the forcing of this great force out of action until the German fleet made another attack. Little or no harm was done by the torpedo attack, but great harm resulted from the imaginary possibilities of this form of attack.

The writer of the "Lessons" states "It seems more like superior marksmanship" that sank the three English battle cruisers than lucky shots. It is known that some of the English and German battle cruisers received more hits in the course of the battle than the ships that sank, so the hits received by these ships must have been hits in a peculiarly vulnerable spot.

On page 1890, we find another writer ascribing the loss of these three ships to the lack of knowledge of British constructors, and their application of the same, of the accidents on the *Missouri, Kearsarge* and *Georgia*. Another writer might ascribe the loss to the faulty handling of the English forces by which in the case of the *Invincible* there was a concentration of two or more ships on the former, at a range of about 10,000 yards. In the case of the other two though they received but few hits, this might have been made more difficult by a rapid closing of range until the English were as sure to hit as the Germans, if a fight was to be carried on; or by remaining out of gun range if the strategy required this course. A long range action is just as objectionable today as in Nelson's time. A long range is a range at which the percentage of hits is so small, that all are chance hits. A short range is one where the chances are more than even for hitting under battle conditions, which means being hit. Such an action should be decided in half an hour. If the strategy calls for an action then the fight should be pushed with all forces, if it does not then it should be avoided.

The writer of "Practical Lessons," states that it is "inconceivable" that the British commander-in-chief did not desire to renew the action at daylight, but it is the only conclusion that a study of the disposition of the fleet during the night, can lead to. The distance was short, so that the fleet must

be united at daylight to make the attack, and no provision was made for this. The second in command did not join the flag until the afternoon; the battle cruisers until several hours after daylight, and the destroyers the same. The German forces were united at daylight. The wide dispersion of the English forces prevented that cohesion essential to having the fleet ready at daybreak for action. This was due to the fear of the destroyer that did nothing during the night to the English and little to the Germans. This was not due to lack of capable destroyer officers, because we know what they were willing to attempt to do, by the day action. But it was due to the inherent limitations of the craft, and the personnel. The latter had been under a terrible strain all day. *The correct estimate of a situation by the commander-in-chief will lead to success,* but it must be based on knowledge of personnel and materiel, as well as conditions, and not influenced by imaginary dangers to be correct. The English commander-in-chief had the choice of a fight at daybreak, or the academic night destroyer attack, but he could not have both.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

Membership Life, regular and associate, 4975.
New members, 11. Resignations, 206. Dropped, 345. Deaths, 3:

Rear Admiral C. H. Davis, U. S. N. (Ret.).
Commander John Blish, U. S. N.
Lieut. A. J. Sellman, U. S. N.

Practically the whole service receives the benefit of the PROCEEDINGS yet many officers, who read it monthly, are not members and therefore contribute nothing to the support of the Institute. Members are requested to urge non-members to join. Publication costs are now so high that the Institute is carrying a loss. The cost, per member, however, decreases with an increase in membership.

Special Notice Referring to Appendix of the new edition of the *Manual of International Law,* page 339, fourth line from the bottom, after the words "United States," the following was omitted:

"as a station or place of resort for any warlike purpose or for the purpose of obtaining any facilities of warlike equipment; and no ship of war or privateer of either belligerent shall be permitted to sail out of or leave any port, harbor, roadstead, or waters subject to the jurisdiction of the United States."

Slips containing this correction are now being printed and copies will be furnished to any purchaser of the *Manual of International Law,* upon application to this office for same.

Dues The annual dues ($3.00) for the year 1922 are now payable.

Regular and associate members of the U. S. Naval Institute are subject to the payment of the annual dues until the date of the receipt of their resignation.

Discussions

Discussion of articles published in the PROCEEDINGS is cordially invited. Discussions accepted for publication are paid at one-half the rate for original articles, or about $2.25 a page.

Address of Members

To insure the delivery of the PROCEEDINGS and other communications from the U. S. Naval Institute, it is essential that members and subscribers notify the Secretary and Treasurer of every change of address, without delay.

Book Department

The Institute Book Department will supply any obtainable book, of any kind, at retail price, postage prepaid. The trouble saved the purchaser through having one source of supply for all books should be considered. The cost will not be greater and sometimes less than when obtained from dealers.

The Boat Book, 1920 and *The Landing Force and Small Arms Instructions*, 1920, are now ready for issue. The price of the former is $.50 and the latter $1.00 per copy.

Index to Proceedings

The attention of readers of the PROCEEDINGS is invited to the classified analytical index for numbers 101 to 200 inclusive, which is noticed under "Publications." This is a most complete index, which has been prepared at considerable expense in order to make readily available the information contained in both the articles and the notes of these issues. Only a limited number of copies is being printed. Price, bound in cloth, $2.35; bound in paper, $1.85.

Articles

The Institute desires articles of interest to all branches of the service, including the reserve force. Attention is invited to the fact that the submission of articles is not limited to members, and that authors receive due compensation for articles accepted for publicaton.

All articles and discussions submitted by persons belonging to the navy for publication in the PROCEEDINGS must be in duplicate, one copy being signed by the author, which will be submitted to

the Navy Department when the original is published, as required by General Order No. 46, of May 20, 1921.

Reprints of Articles

The attention of authors of articles is called to to the fact that the cost to them of reprints other than the usual number furnished, can be greatly reduced if the reprints are struck off while the article is in press. They are requested to notify the Secretary and Treasurer of the number of reprints desired when the article is submitted. Twenty copies of reprints are furnished authors free of charge.

Illustrations

Authors of articles submitted are urged to furnish with their manuscript any illustrations they may have in their possession for such articles. The Institute will gladly co-operate in obtaining such illustrations as may be suggested by authors.

Original photographs of objects and events which may be of interest to our readers are also desired, and members who have opportunities to obtain such photographs are requested to secure them for the Institute.

Notice

Whole Nos. 6, 7, 10, 13, 14, 15, 17, 144, and 173 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., February, 1922.

INFORMATION INDEX

	PAGE
ADVERTISEMENTS, INDEX TO	1
PUBLICATIONS, U. S. NAVAL INSTITUTE	(2)
SPECIAL NOTICE	339
TOPICS FOR ESSAYS	341

PROFESSIONAL NOTES

PREPARED BY

LIEUTENANT R. A. HALL, U. S. NAVY

GENERAL ARRANGEMENT

VESSELS BUILDING.	France	277
NAVAL POLICY.	Germany	280
MATÉRIEL.	Great Britain	281
PERSONNEL.	Japan	287
MERCHANT MARINE	United States	288
AERONAUTICS		303
ENGINEERING		311
NAVIGATION AND RADIO		317
ORDNANCE		319
MISCELLANEOUS		320
CURRENT NAVAL AND PROFESSIONAL PAPERS		320

FRANCE

FRENCH NAVAL OPINION—Despite the superficial optimism it is felt here that the Washington Conference has not advanced, so much as had been expected, the cause of international goodwill and peace, which underpopulated and war-ruined France has at heart more than any other nation, and which she shows by adopting towards treacherous Bocheland an over-lenient attitude. The several incidents to which the active Boche anti-French propaganda has recently given rise have made a deep impression, even in those Paris political circles most hostile to militarism, and Clemenceau's advice is being recalled: *"Souvenez-vous que l'humanité ne changera jamais, et que la France pacifique doit, aux dangers spéciaux de sa situation géographique, d'être toujours prête au combat, sous peine de mort."* Premier Briand was, of course, conciliatory and eloquent as always, but in Parliamentary quarters here the opposition is growing against a disarmament policy placing France at the mercy of her neighbours. Moreover, the anti-French outrages in Italy show Frenchmen that the dangers they have to guard against are many and that Mediterranean supremacy is to them a vital necessity.

No undue importance is attached here to the projected clauses limiting the displacements of navies. Size has never been, and never will be, the true measure of sea power. The 27 sea-battered ships of Nelson, with their seasoned and disciplined crews and their splendid officers, represented infinitely greater value than the odd collection of 33 lame ducks under Villeneuve. And with the changed conditions of warfare, and the growing

importance of strategic *points d'appui*, fuel dépots, and repairing bases, a given number of warships express nothing more than possibilities and potential power, without moral and material preparedness for war, without ample financial expenditure capable of supplying a fleet with the up-to-date armament and the repairing and the strategic facilities it needs for successful operations in all seas. The 24,000 ton Bretagues, for instance, have preserved on paper unchanged value; yet their offensive and defensive power has been increased by at least 50 per cent as the result of the costly modifications they have received. Their new shells have proved wonderful against the thickly-armoured *Thüringen*, that was sunk at a range of 14,000 mètres by 13.4-inch delayed fuse projectiles. Finances did it; finances alone permit constant sea practice and complete preparation for war in its many aspects. Therefore, financial expenditure is a better criterion of strength.

One of the reasons of the French indifference towards the Washington disarmament proposals is the prevalent belief in Parliamentary circles that a revolution is impending in the scientific line that will render obsolete most of the weapons of today, the mighty battleship included. The very limitations imposed on Germany and the suppression of the greater part of her existing and "visible" armament, by concentrating the whole Boche preparation in the intellectual field and in laboratories, will, of course, contribute to bring about the advent of new and more economical, swifter, and more deadly weapons that will make the devastating conflict of yesterday look like child's play in comparison with tomorrow's warfare. In the new game Bocheland has every chance to lead; her chemical production plant and laboratories are still easily first, despite the belated efforts being made in France, the several accidental explosions in German "agricultural works," and especially at Oppau, where the conflagration of "agricultural gas" caused an excavation 130 mètres wide and 30 mètres deep—these facts speak loudly enough of what is in store for Bocheland's enemies.

Count Zeppelin's son, head of the great and thriving Zeppelin aeronautical firm, speaking to a French officer, said: "It has been a good thing you stopped us in our work, for it has compelled us to look for new and better things, and we have found them. Hence my faith in the future of greater Germany." Député Fonck, who is considered here as the greatest living aviator, recently summed up a lengthy visit to Germany by saying: "From what I have seen or ascertained Germany has the means, within a few weeks' time, of excelling France in the air both by the quality and number of her aerial machines," whilst a French artillery general commanding on the Rhine has expressed his belief that as soon as Boche propaganda has succeeded in dissociating the Allies, Germany will strike and immediately assert her superiority in the aero-chemical warfare and reverse to her advantage the Versailles Treaty. Obviously, no disarmament clauses could effectively impede that novel line of war preparation that is wholly a matter of aggressive spirit served by industrial power.

The French submarine flotillas have been reinforced by the addition of ex-German boats, refitted and modified at great cost in the Brittany and Normandy arsenals. The *Marras and Autrie* (U-162 and U-105), of 850-1,150 tons and 2,200 h.p., do not compare well on paper with the French *Laplaces* (950-1,250 tons, 3,000 h.p.) and *Callots* (932-1,300 tons, 2,900 h.p.). Their workmanship is poor, their conditions of habitability are defective, and their German motors do not work quite so smoothly as the Creusot-made Diesels in the latest Gallic submersibles. On the other hand, they are more robust, simpler, and more military, better armed, everything in them having been sacrificed to the fighting utilisation of the displacement. The great defect of French boats is to be "*trop parfaits*," too complicated and consequently too fragile, as the result of lack of practical sea training on the part of our *distingués ingenieurs de la marine*, but there are signs

in post-war submersibles, that the experience of the real thing has not been lost upon the Section Technique experts.

The Senate Marine Committee is again urging the laying down next year of a larger number of submarines than have been provided for under the Guisthau programme, and the Chamber is expected to support this demand for a programme of submarines *"suffisant pour assurer l'entière sécurité des frontières maritimes"*—which is a matter of appreciation and may mean either a big effort or simply the usual shower of academic discourse. Senator d'Estournelles, who advocated the construction of exclusively defensive weapons, was reminded by Senator Berenger that there is no such thing as *"des armes purement défensives,"* since the veriest mosquitoes sank two 20,000-ton Austrian battleships, and since also an avion-torpeilleur may account for the heaviest battleship. Whilst the Chamber counts yet sturdy partisans of a *"flotte de combat,"* the majority of the Senate has gone over to the side of *la Jeune Ecole* and acclaimed Constructor Breguet's recent prophecy: *"Les Dreadnoughts vont disparaître de la surface du globe comme ont disparn les monstres colossaux des temps prehistoriques,"* though the wish was obviously father to the thought in this expression of the views of the famed aerial expert, who sees in the gradual disappearance of mastodons a splendid chance for aerial developments. The latter, however, make for a worse, more cruel, form of warfare than battleships did; and in this respect, indeed, pacifists and humanitaires are backing the wrong horse.—*Naval and Military Record*, 14 December, 1921.

FRENCH AERIAL LIGHTHOUSE—From France it is reported that the French Air Ministry has recently acquired a new aerial lighthouse which is said to eclipse entirely anything that has hitherto been attempted in the way of lighting up the air routes. The new lighthouse, which, it is stated, is to be erected on Mt. Africa, near Dijon, at an altitude of 1,500 feet above sea level, will throw a light which, in clear weather, it is expected will be visible for a distance of 200 miles.—*Aerial Age* Weekly, 26 December, 1921.

THE STATE MERCHANT FLEET.—The fleet of merchant ships that was acquired by the State during the war has been disposed of under much better conditions than had been anticipated. Excluding the colliers, which will remain in the hands of the State for the time being, and the wooden vessels that were built in the United States and are regarded as having very little value, there were 400,000 tons for sale, and it was feared that the throwing of such a large quantity of shipping on the market would have had serious consequences in depreciating the prices obtainable. The Under-Secretary of State for the Merchant Marine succeeded, however, in grouping together shipowners who made a bid for the lot, the price, it is said, being quite favorable to the State and above that recently paid by Belgium for German vessels. The deal was carried out within three months of the passing of the Bill authorizing the sale.—*The Engineer*, 2 December, 1921.

FRENCH TANKER FLEET.—When the war began, the French tanker fleet consisted of one steamer and two sailing vessels. French oil refining interests owned six tankers, but these were operated under the British flag and were subject to the orders of the British Admiralty for the whole of the war. At the present time there are 17 tankers of 159,700 tons deadweight being built for French accounts. All these are scheduled for delivery next year. By January 1, 1923, the French tanker fleet is expected to comprise 24 steam and sailing units of 200,000 tons deadweight.—*Nautical Gazette*, 17 December, 1921.

FRANCE'S CARGO MOVEMENT.—During the first ten months of this year, the weight of French exports was 11,979,289 tons as compared with 10,228,783 tons in 1920 and 17,848,275 tons in 1913. Imports measured by

weight amounted to 27,615,983 tons in the ten months of 1921, as against 40,656,750 in 1920 and 36,426,434 tons in 1913.—*Nautical Gazette*, 24 December, 1921.

GERMANY

GERMANS REDUCE SOUTH AMERICAN FREIGHTS.—The Hugo Stinnes Company for Shipping and Oversea Trade, Hamburg, and the Hamburg Agency of the "Artus" Danzig Shipping and Trade Company, Hamburg Branch, agreed to grant 20 per cent reduction in fares for passengers who travel to the Leipzig Fair. The steamers of the Hugo Stinnes Company call in Brazil at the ports of Rio de Janeiro, Pernambuco and Bahia; in Uruguay at Monte Video; in Argentine, at Buenos Ayres.

The steamers of the Artus Company call at Antwerp on the outbound route and in Brazil at Rio (for passengers only), in Uruguay at Monte Video, in Argentine at Buenos Ayres and Rosario. For the purpose of obtaining the above-mentioned reductions parties interested will have to see the Honorary Representative of the Leipzig Fair Bureau in the respective country, who will issue the necessary vouchers—i.e., in Brazil, Union of German-Brazilian firms, Rua da Alfandega No. 5; in Uruguay, Mr. Groscurth, member of the firm of Croscurth and Co.; Monte Video, Casla dos Correa 66; in Argentine, A. Hartrodt; Buenos Ayres, Calle Reconquista 81.

The above-mentioned reductions will take effect for the first time in the Spring Fair (March 5-11, 1922).—*Engineering and Industrial Management*, 24 November, 1921.

GERMAN SERVICES RESTORED.—The Hamburg-American Line and the North German Lloyd have renewed their pre-war joint service of cargo steamers from Hamburg and Bremen to East Asiatic ports. The restored service was inaugurated by the Hamburg-American Line's motor ship *Havelland* which was despatched last Sunday. She will be followed on January 7 by the North German Lloyd steamer *Westfalen*.

The Hamburg-American Line has also resumed its passenger service to South America with the steamers *Teutonia*, formerly the *Hapsburg*, and the *Rugia* which were repurchased from the Allies. These vessels have accommodations for first and third class passengers and will call at Rio de Janeiro and Buenos Aires.—*Nautical Gazette*, 10 December, 1921.

THE GERMAN MERCHANT NAVY.—The recovery of the German merchant navy is progressing at a very fair pace and during the present year the tonnage has increased from 428,000 tons to about 700,000 tons. At the larger German yards 45 vessels are stated to be in course of construction, and a number of foreign vessels are being purchased. Thus seven good boats of the Swedish Johnsen Line have just been transferred, much to the regret of the Swedes. Their aggregate tonnage is 46,340 tons deadweight and amongst them are the two sister vessels *Axel Johnsen* and *Annie Johnsen*, built at Lindholm some ten years ago, the first Swedish-built ocean-going boats. The types at present attracting most attention in Germany are vessels of 10,000 tons to 15,000 tons deadweight.—*Engineering*, 2 December, 1921.

GERMANY'S FOREIGN TRADE.—Estimated figures for Germany's foreign trade during September and October show that both imports and exports are increasing. Total imports for October are estimated at 3,000,000 metric tons, valued at 13,900,000,000 paper marks, as against 2,500,000 metric tons in September, valued at 10,668,000,000 paper marks. Total exports for October amount to 1,970,000 metric tons, valued at 9,700,000,000 paper marks, as against 1,870,000 metric tons in September, valued at 5,519,000,000 paper marks.—*Nautical Gazette*, 24 December, 1921.

GERMAN MERCHANT MARINE TOTALS MILLION TONS.—The German merchant marine has had a phenomenal growth during the last few months

states *Commerce Reports* and now totals around one million tons. Compared with the tonnage of July, 1921, this shows a gain of approximately 250,000 tons. In spite of the rapid increase in German shipping it is estimated that 80 per cent of the country's foreign trade is being carried in foreign bottoms. The share of the United States in this total amounts to 3 per cent.—*Nautical Gazette*, 31 December, 1921.

GREAT BRITAIN

BRITAIN'S NEW BATTLE CRUISERS.—Early in September the Admiralty invited bids for the construction of the first four capital ships which have been authorized for the British Navy since 1916. They are officially described as "replace" ships, and before they are placed in commission at least eight of the older dreadnoughts will have gone to the junk heap. It is understood that tenders for the hulls, machinery, and equipment of the new ships have already been submitted by the leading shipbuilding firms, and an early announcement as to the allocation of the contracts is expected. In former times it was the custom to allot one big ship of each year's program to the Royal dockyards at Portsmouth, and Devonport, respectively, but this was impossible in the present instance because the building slips at these yards are not large enough to take vessels of such colossal dimensions as those of the post-war capital ship. Consequently, all four units are to be built by contract, and in view of the uncertain state of the labor market and the fluctuating price of materials it is not improbable that the work will be done on a cost-plus-profit basis.

Battle Cruisers with Heavy Armor

Up to the present only the meagerest details of the new ships have been published officially, and the Admiralty shows no inclination to disclose further particulars. But from hints dropped in the House of Commons during the recent debate on the Navy Estimates and from various statements made in well-informed quarters it is possible to visualize the essential features of the design. Although they are officially designated battle cruisers, the new ships will be slower than the *Hood;* but they will have thicker armor and a much more powerful battery. They may therefore be taken as representing a virtual amalgamation of the battleship and battle cruiser types, a course which has been stongly urged by British naval officers with war experience.

The striking lessons of the late war have, indeed, profoundly modified the British estimate of tactical values. Ten years ago there was a veritable craze for speed, and in order to gain an extra knot or two hitting power and protection, but especially the latter, were cheerfully sacrificed. Several of the British battle cruisers with the Grand Fleet carried thinner armor plating than that of the German pre-dreadnoughts, and their sides were penetrable by heavy-caliber shell at almost any effective range. Furthermore, weight had been saved by thinning down the armor on turrets and barbettes, and by fitting horizontal protection that could offer no serious resistance to heavy blows.

Ten-Minute Ships

Even before the war the vulnerability of these ships was well known in Germany. Admiral von Tirpitz dubbed the "Invincible" class "Fisher's ten-minute ships," thereby implying that they would succumb to attack by gunfire in ten minutes. Jutland unhappily vindicated the accuracy of this German estimate. The *décuirassement* doctrine, initiated by Lord Fisher, found its most striking expression in the battle cruisers *Renown* and *Repulse*, built during the war. These ships were fitted with narrow belts of 6-inch armor, and when they joined the Grand Fleet at Scapa Flow Admiral Jellicoe, realizing their fatal weakness, refused to incorporate them

in his battle formations until they had been taken back to dockyard and fitted with thicker plating over vital parts. Since the war the *Repulse* has been partly reconstructed, and in place of her original belt now has a deep girdle of 9-inch armor. Also, the anti-torpedo bulge has been broadened and deepened—changes which have increased her fighting efficiency by 50 per cent. Her sister, the *Renown*, will undergo a refit on similar lines when opportunity offers.

Improving on the *Hood*

In the *Hood*, which was designed before the Battle of Jutland, but not actually laid down till afterwards, an attempt was made to embody the lessons of that action by increasing the armor belt from 8 to 12 inches and the barbettes from 9 to 12 inches, involving an additional weight of nearly 5,000 tons. But the *Hood*, after all, was a compromise, and has been explicitly repudiated by the Naval Staff as a genuine post-Jutland type. They consider her design to be wasteful in that it allows a battery of only eight big guns on the enormous displacement, at full load, of 44,600 tons, and they are not satisfied with her protection against flat trajectory and high-angle fire. All these faults are to be remedied in the new ships, the plans of which have probably received more attention than was bestowed on those of any previous unit of the Royal Navy. Briefly stated, their salient characteristics are: a numerous battery of 16-inch guns in triple turrets, side armor proof against perforation at long range, and very stout horizontal protection; moderate battle cruiser speed, but a very extensive cruising radius; duplication of controls for every important element of the maneuvering, gunnery, torpedo, and signalling organization. The following data, not being official, must be accepted under reserve, but they are believed to be substantially accurate: Length over all, 850 ft.; extreme breadth, 104½ ft.; mean draft, 29 ft.; normal displacement, 43,500 tons. How many 16-inch guns will be mounted is not definitely known, but alternative arrangements of ten guns in two triple and two double turrets, and twelve guns in four triple turrets, have been suggested. The machinery will be geared turbines supplied by small-tube boilers, the plant developing up to 125,000 shaft horse-power. According to this figure the maximum speed will probably be about 29 knots. The proposal to equip one ship with the electric drive has been rejected, as this method of propulsion is not viewed with favor by British naval engineers. The machinery will account for about 9.5 per cent of the total displacement, as against 13 per cent in the *Hood*. This fact is significant of the diminished value now attached to speed by the controllers of the British Navy. The oil stowage capacity will be sufficient for a run of 10,000 nautical miles at economical speed, enabling the ships to steam from England to Hong Kong without refuelling. No details of the armor system are accessible, but it is known that valuable pointers were obtained from the firing experiments at the ex-German battleship *Baden* last March and from several other tests conducted in the past twelve months.

Why the 18-Inch Gun Was Rejected

From the gunnery viewpoint the most interesting feature of the new ships is the introduction of the 16-inch caliber, which is new to the British Navy. Some thirty years ago a 110 ton piece of 16¼-inch caliber was mounted in a few ships, but was eventually discarded on account of its abnormal weight and slow rate of fire. Why the 16-inch gun should have been adopted at this stage is something of a mystery to the uninitiated considering that the new mark of 15-inch mounted in the *Hood* has proved to be a thoroughly satisfactory weapon. But the explanation is simple enough. The Naval Staff, presided over by the First Sea Lord, Earl Beatty, is said to have been in favor of mounting 18-inch guns in the new

battle cruisers. Guns of this caliber were actually made during the war and displayed magnificent ballistic qualities both on the proving ground and in action against the German positions on the Belgian coast. The monitor *Lord Clive*, armed with a single 18-inch gun, made accurate shooting at 42,000 yards, and on the eve of the armistice this vessel, together with another monitor similarly armed, was preparing to bombard Bruges at a range of 50,000 yards. All who have seen the 18-inch gun at work are in agreement as to its fine properties. Notwithstanding its great weight—160 tons—it can discharge one round per minute, and its accuracy at all ranges is far superior to that of smaller caliber weapons. Had military and technical considerations alone prevailed, there is little doubt that the new British battle cruisers would have been armed with 18-inch batteries. But the Cabinet, according to rumor, opposed such an armament, on the ground that it might be construed as a challenge by other Powers, notably the United States and Japan, and inaugurate a new international competition in "tons and guns"—a development which British statesmen are particularly anxious to avoid. This is probably the first time on record that the design of British fighting ships has been influenced by diplomatic considerations, but, looking at the matter in a broad light, few will question the sagacity of the Cabinet's attitude. Japan, at any rate, is known to have designed an experimental 18-inch gun, if she has not actually built one; and as for the United States, it is all but certain that the later capital ships of the current program would have been re-designed for an 18-inch armament had weapons of this caliber been selected for the British battle cruisers.

But the Naval Staff, having been denied the 18-inch gun, was determined that its new ships should not be inferior to their foreign contemporaries, and therefore resolved to introduce the 16-inch model, which had previously been adopted for the capital ships of the United States and Japan.

The New 16-Inch Gun

As shown in Vickers' list, the new gun is 741.25 inches in length, the bore being 720 inches long, and the total weight 117 tons. The armor-piercing projectile weighs 2,240 pounds, and is fired with a muzzle velocity of 2,450 foot-seconds and an energy of 93,230 foot-tons. With an uncapped projectile the penetration of wrought-iron plate at the muzzle, according to the Gavre formula, is 57 inches. The maximum rate of fire is 1.2 rounds per minute. A shorter model of the same gun, 43.65 calibers in length, weighing 107¾ tons, and firing a 2,461-pound shell, is also listed by Vickers. In both cases the weight of the projectile, it will be noted, exceeds that of the American 16-inch shell, though the muzzle velocity is less. As mounted in the new ships the 16-inch gun will be capable of elevation up to 35 degrees, at which angle the extreme range will be over 40,000 yards. Apart from the increased range obtainable, the advantage of giving the main guns a generous angle of elevation is that it enables them to keep bearing on the target even though the ship be listing heavily as the result of damage on or below the waterline.

British Adopt 3-Gun Turret

The turrets will be of a new pattern, built up of 15-inch or 16-inch armor on the exposed parts, with a flat roof that will offer no "bite" to descending shell. Each of the three guns in the turret will have independent elevating gear. All the turret machinery will be hydraulic, for although British naval engineers are fully alive to the merits of electricity for this purpose, they still believe in the all-round superiority of the hydraulic system.

The secondary battery will comprise 16 rapid-fire guns of 5.5-inch or 6-inch caliber. Although introduced only six years ago, the 5.5-inch has become popular in the Navy owing to its light weight compared with the

6-inch and its very high rate of fire. The projectile weighs 82 pounds, and is considered sufficiently heavy for the attack of hostile destroyers or submarines. Each of the new ships may carry as many as 12 torpedo tubes, all or nearly all mounted above the waterline. Professional opinion has turned against the submerged tube owing to its repeated failures during the war. Torpedoes fired from these tubes when the ship was traveling at high speed did not run straight, apparently because the sliding bar, or "spoon," failed to protect the torpedo from the lateral pressure of water as it emerged from the tube. Moreover, there were several cases of the bars bending under the strain, and more than one ship had to return to dock-yard to have a buckled torpedo bar withdrawn. For these reasons the modern tendency is to mount torpedo tubes above the waterline, where they occupy much less space and are far simpler to operate.

New "Hoods" To Be Built Slowly

According to present plans, the four new battle cruisers are all to be in commission early in 1925. Their keels will be laid during the coming winter, and the building period is to extend over 36 months. Not more than £2,500,000 is to be expended on the work during the current fiscal year, which terminates on March 31. No credence should be attached to recent rumors that the British Admiralty has a further big program of construction up its sleeve. Further British naval policy will, of course, be influenced by the outcome of the Washington Conference, and it is a fact that the people of Britain fervently desire a happy issue both on political and economic grounds. Burdened as they are with a heavy load of war debts and crushing taxation, they are not prepared to sanction any ambitious scheme of naval aggrandisement which cannot be shown to be absolutely vital to the national safety. It is true that the four-ship program, involving a total first cost of about £30,000,000, has been accepted without serious criticism, but this is because the country realizes that unless something is done at once to replace obsolete material the British Navy a few years hence will have declined to third place and the Empire would henceforth be existing on sufferance.

It may be said in conclusion that the new battle cruisers fall considerably below the ideal cherished by British Naval tacticians. Not only has their design, as mentioned above, been influenced by political considerations, but the Admiralty constructors have had to work inside a definite financial limit, which compelled them to keep within relatively modest dimensions. The "ideal capital ship," as defined by Sir George Thurston, Vickers' well-known designer, would be a vessel 932 feet in length, 112 feet broad, drawing 31½ feet of water and displacing 57,000 tons at legend draft. She would have machinery of 200,000 S. H. P. for a speed of 33½ knots, and be armed with a main battery of eight 18-inch 45 caliber guns. Monsters such as this may possibly be afloat in a few years' time, but it is more than doubtful whether the first of them will fly the British flag.—*Scientific American*, December, 1921.

CAPETOWN TO COMMISSION FOR FOREIGN SERVICE.—At the termination of her official trials, for which she is to be commissioned as soon as possible, the new light cruiser *Capetown*, now completing at Pembroke Dockyard, will be completed to full crew from Devonport Depôt in March for service on the North America and West Indies Station, where she is to relieve the *Cambrian*.—*Naval and Military Record*, 14 December, 1921.

TANKS TO BE CONSTRUCTED AT SINGAPORE.—It is announced by "Modern Transport" that the Wessoe Foundry and Engineering Co., Ltd., Darlington, have recently been awarded by the Admiralty the contract for the supply and erection in Singapore of ten steel oil-fuel tanks, each 116 ft. in diameter, by 45 ft. 6 in. Each tank will be capable of holding about 12,000 tons of oil.—*Naval and Military Record*, 14 December, 1921.

SUCCESS AT WASHINGTON.—Now that Japan has signified her adhesion to the formula of naval tonnage proposed by the United States and accepted by the British Empire, and has further expressed her readiness to join with those Powers and France in a treaty which aims at securing a peaceful settlement of all disputes likely to arise in the Pacific, it may be said that the Washington Conference has achieved an extraordinary measure of success. Many matters of detail remain to be settled, some of which may prove more difficult than is commonly assumed; but in view of the good-will and forebearance which has been displayed by all the Powers concerned so far as the negotiations have gone, there is every reason to anticipate a complete and satisfactory adjustment of the minor issues still outstanding. The first and most obvious result of the Conference will be the elimination of that dangerous form of international rivalry which finds expression in naval shipbuilding.

A great deal of the credit for having made possible the suspension of competition in armaments belongs to the British Government, which had announced, well in advance of the Conference, its readiness to accept the principle of naval equality with the United States. That, we believe, was the first step which led up to the present arrangements, for it would not have been possible to propose a graduated scale of naval armaments unless the two leading maritime Powers had previously come to an understanding on the subject. Once that had been reached, the rest depended on good statesmanship, of which there has certainly been no lack on the American side. Apart from its material results, the most gratifying feature of the Conference has been the fraternal co-operation between this country and the United States. The American Press generously acknowledges the wholehearted support which the British delegation has rendered to Mr. Hughes throughout the proceedings. There can be no doubt that this demonstration of unity between the two nations which together exercise a dominating influence on the world's affairs deeply impressed the other participants, and was the chief factor in checking any obstructive tactics which may have been contemplated.

With the broad features of the limitation scheme already accepted, it becomes possible to estimate the effect it will have on the navies concerned. We do not hesitate to say that the British Empire is a gainer by the scheme, for it leaves us relatively stronger at sea than we should have been had the various programmes been allowed to mature. The four ships it was proposed to lay down this year would not have sufficed to keep us even at the same level of strength as the United States, and in order to maintain a bare equality in post-Jutland ships we should have been compelled to build eight or twelve further vessels during the next few years. Moreover, any additions to the American programme would have necessitated a corresponding increase to ours. The financial burden entailed by such a policy would have been colossal. It is doubtful, indeed, whether the depleted resources of this country would have been equal to it, for the Dominions could have given us but limited help.

Some may hold that the United States, wealthy as she is, would never have entered into an actual building-slip competition with us, but would have been content with a navy of approximately the same dimensions. That may be so, but there is no proof of it. Thanks to the war and the big-Navy propaganda which was conducted in the United States a few years ago, the American people are more interested in sea power today than at any previous period of their history, and it is quite likely that had no agreement been reached they would have insisted on maintaining the lead in naval strength.

Our sacrifice of the four new battle cruisers—if "sacrifice" be an appropriate term in this connection—has therefore been amply repaid. In relative strength we have gained appreciably. We are left for the time

being with what is unquestionably the finest and most formidable battle fleet in the world. The foreign ships of post-Jutland type whose completion might have rendered it obsolete will not now be built. The *Maryland* and the *Nagato* are the only vessels of this type afloat, and, while their paper value is higher than that of any British battleship, the *Hood* is a sort of counterweight to either. Besides, a main battle fleet comprising ten 15-inch gun ships, with a reserve of eight ships carrying 13.5 in., we retain four battle cruisers which will continue to represent a squadron of unique power and mobility. These ships would have been largely negatived by the Japanese Amagi class and the U. S. Constellation class.

But the real merit of the naval agreement is that it does not benefit one Power at the expense of another. America may have forfeited the chance of attaining naval supremacy, which would in any case have been of doubtful value to her; but she has escaped the necessity of spending enormous sums on ships, bases, and fortifications to make her Pacific possessions secure. What is more, she has averted the peril of a war which, as her experts know full well, would have been by far the greatest and most terrible adventure in which she had ever engaged. It would not be easy to exaggerate the difficulties and dangers that would confront the United States, if she found herself in conflict with Japan. All the strategical advantages would rest with the latter, and while the struggle might be decided in the end by economic staying powers, the American people would assuredly have to undergo a bitter ordeal before they prevailed.

Japan is not the least of the beneficiaries under the scheme. By a stroke of the pen she has been freed from the dead weight of an expenditure on armaments which was out of all proportion to her resouces. Rightly or wrongly, she deemed it necessary to spend no less than half her income on battleships and battalions, and consequently had little to spare for the other public services, including education. The progress of Japan towards that high standard of civilization to which she aspires was therefore seriously impeded. Popular discontent at the crushing taxation had lately been manifesting itself by symptoms that filled the ruling class with alarm. The communistic creed was making rapid headway among the workers, and the domestic outlook was becoming grave. The root cause of all these troubles was the Government's policy in regard to armaments, which not only devoured huge sums of money, but strengthened the militarist party and encouraged it to persevere with aggressive schemes abroad whilst pursuing a policy of reaction at home. A reduction of armaments on the scale now agreed to will do much to shake the position of the Japanese militarists, and may pave the way for a more liberal régime.

On the other hand, it will leave Japan strategically in a position every whit as favorable as that which she would have occupied had the "eight-eight" building scheme and the army program both come to fruition. This was undoubtedly the conclusion which led so ardent a navalist as Admi. Baron Kato to accept the American proposals with so little demur. Whether the agreement respecting the future attitude of the Powers in China will be as favorably received in Japan remains to be seen. Her vested interests in China are great, and, unless these receive adequate acknowledgment in the four-Power Treaty, it is to be feared that she will prove but a luke-warm adherent to the compact. She may justly lay claim to preferential treatment in China, and will doubtless be found to have received it when the full text of the agreement is made public.—*Naval and Military Record*, 14 December, 1921.

NAVAL ATTACHÉS.—A very much wider scope appears now to be given to the office of Naval Attaché. Not only is the number of British naval

officers so employed higher now than it was before the war, in spite of the fact that Berlin, Vienna, and Petrograd have dropped out of the list of capitals to which Attachés are sent, but in selecting officers for such appointments the Admiralty do not now restrict themselves, as formerly, to those in what used to be known as the executive branch. A few months ago, attention was directed to the appointment of Paymaster Lieutenant-Commander Lloyd Hirst as Assistant Naval Attaché in South America—the first officer of the accountant branch to be chosen for such a post. Since then, as a glance at the new *Navy List* will show, the Admiralty have further widened the field of selection by the appointment of Engineer Commander Harold A. Brown and Constructor A. G. W. Stanton, R. C. N. C., as Assistant Naval Attachés at Washington. Appointments of this kind point to the fact that duty as Naval Attaché is now regarded from a utilitarian standpoint rather than from the social or diplomatic point of view only, and officers are sent who, as students of the technical or administrative progress of Navies are able to keep the Admiralty well informed on such matters.—*Army, Navy, and Air Force Gazette*, 10 December, 1921.

JAPAN

THE MITSUBISHI WORKS.—An attractively printed and illustrated brochure entitled *An Outline of Mitsubishi's Enterprises* has recently been published. The Mitsubishi group numbers among its activities shipowning, shipbuilding, engineering, iron and steel manuafcturing, coal mining, marine and fire insurance, banking, estate-owning, etc., etc., and it thus holds a most important position in the commercial life in Japan.

The Mitsubishi Zosen Kaisha (Mitsubishi Shipbuilding Co., Ltd.) has a capital of $50,000,000 yen, and has become the largest shipbuilding concern in the Far East. The principal undertakings of the company are the building and repairing of warships, passenger and cargo steamers, cross channel ferries, etc; the manufacture of electrical machinery, engines, boilers, and general machinery; the manufacture of torpedoes, and other implements of war; and iron and steel manufacture. The head office is at Tokio, and the works are situated at Nagasaki, Kobe and Hikoshima, with armament works and steel works at Nagasaki.

The Nagasaki Works comprise dockyards, factories, etc. At Akunoura there are numerous engine shops, including machine, fitting, turbine and electric shops, etc. On the jetty is an electric hammerhead crane with a lifting capacity of 150 tons. The Tategami Shipyard has eight concrete building berths, the largest of which is 767 ft. long and is worked by overhead cranes running on gantries the full length of the berth. Joiners' shops, saw mills, riggers' shops, etc., are also installed. The three graving docks have a length of 423, 371 and 729 ft. respectively, and the patent slip has a length of 228 ft. at the carriages. One of the latest additions to these works is an experimental tank.

At the Kobe Works are foundaries, machine, electric, rigging, sail and pattern shops, etc. The three concrete building berths are 510 ft. long, and there are also three smaller berths for submarines, as well as three floating docks. The last-named can lift vessels of 7,000, 12,000 and 16,000 tons respectively.

At the Hikoshima Works are three graving docks, 369, 460 and 264 ft. long respectively, with the necessary machine, blacksmiths', foundry and fitters' shops.

At the Nagasaki Works, 1,300 officials and 17,000 workmen are employed, and the shipbuilding capacity is about 100,000 tons per annum. The Kobe Works have a capacity of 40,000 tons of new shipping annually, and employ 500 officials and 9,500 workmen. At the Hikoshima Works

there are 70 officials and 700 workmen employed.—*The Shipbuilder*, December, 1921.

THE FAR EAST.—A news item that does not appear to have been given the prominence in the American press to which its importance entitles it relates to the recent occupation of Kamchatka by the forces of the government of the maritime province of Siberia. This government was created under Japanese supervision as the result of an insurrection fomented by Japan against the Far Eastern Republic, and its actions are to all intents and purposes the actions of Japan. The important phase of the occupation of Kamchatka is the possession which it gives Japan of Emma harbor at Petropavlosk, lying within 250 miles of the Aleutian Islands, and as a naval base controlling the whole northern Pacific route from America to the Far East.

Emma harbor is the only real harbor in north Pacific waters. It is open at all seasons and is sufficient to accommodate and base the largest fleet. As the Japanese already hold possession of islands directly on the route to the Philippines via Hawaii and Guam, Emma harbor is the only remaining terminal to a Pacific route that would be free from danger of attack by Japanese submarines. In the possession of Japan it effectively covers her northern flank and serves as the base of departure for an eastward advance.—*Army and Navy Journal*, 17 December, 1921.

JAPAN SPONSORS CIVILIAN FLYING INSTRUCTION.—Under regulations of the Japanese War Department, young men between the ages of 17 and 20 years, who are desirous of receiving training with a view to becoming civil aviators, are accepted as pupils by the Chief of the Air Board provided they fulfill certain requirements. The instruction of the air pupils at the Army Flight Schools lasts for eight months.

The number of pupils assigned to take the course each year is fixed by the Chief of the Air Board, and vacancies may be filled by him from among those who took the examination for admission and were not previously admitted.

When air pupils have completed their course of study, the Commandant of the Army Flight School awards them certificates of completion and reports the result of their study to the Chief of the Air Board through the Chief of the Army Technical Department.—*Aviation*, 19 December, 1921.

OSAKA SHOSEN KAISHA.—For the half year ended June 30th, 1921, this company reports gross earnings of Y30,070,446 and a net profit of Y5,045,682 as against Y50,448,571 gross earnings and Y12,260,464 net profit for the corresponding period of 1920. In their report the directors say that, on account of the world-wide trade depression, the results achieved were exceedingly bad. In almost every trade the showing was unsatisfactorory. The company's fleet, including vessels under construction, consists of 190 vessels of 460,091 tons.—*Nautical Gazette*, 10 December, 1921.

UNITED STATES

DELIVER SEAPLANE CARRIER.—The Todd Shipyard Corporation has turned over to the United States Navy the U. S. S. *Wright* which has been converted into a balloon and seaplane mother ship in the Tietjen and Lang Shipyard, Hoboken. The vessel is named in memory of Wilbur Wright.

The *Wright* was originally built for the transport service and the alterations include space for the stowage of six kite balloons, a plant for generating hydrogen and repair plants for balloons and seaplanes. The vessel will carry spare wings and other parts and will also be equipped with a pigeon coop, aerological laboratory and a complete photographic

laboratory. She will be armed with four five-inch guns and two machine guns.

The *Wright* is 448 feet long, 58 feet beam and 31 feet depth and of 14,240 tons displacement. She will have a cruising speed of 15 knots.—*Aerial Age Weekly*, 26 December, 1921.

TO SALVAGE OBSOLETE WARSHIPS.—Of special interest at this time is a meeting which will be held next Friday at the navy yard, Philadelphia, of the representatives of leading business men, financiers, shipbuilders, steel operators, scrap dealers, chambers of commerce, and editors of trade papers to confer with representatives of the Navy on the subject of scrapping the obsolete vessels of the Navy. These vessels are offered for sale on January 16 and include the battleships *Maine, Missouri, Wisconsin*, cruisers *Brooklyn, Memphis*, and *Columbia*, the monitors *Ozark, Puritan, Miantonomoh*, and *Tonopah*, and several destroyers and other craft. These vessels are not fit for use as cargo ships, and the naval authorities know of no concern operating in this country with facilities for breaking up big steel-built ships. The present offering, bids for which are invited for January 16, constitutes an unusually large group of vessels to be sold as hulks; and with the Hughes proposals looming large in the horizon, it is thought at the Navy Department that this is a peculiarly suitable occasion to encourage the development of the industry, which has flourished in England for years, for the breaking up of obsolete steel ships. Over there a standard price prevails of about 2½ cents a pound net to the government for old naval vessels, at which figure the navy obtains a fair price and the ship-breaking concerns thrive because of the permanency of the industry. The forthcoming conference at Philadelphia is expected to produce results in the way of bringing about such facilities in this country; and to that end the business men will be shown about the back channel—the cemetery of the Navy—and invited to present a plan of financing and developing a ship-scrapping organization which can extract the useful material from these vessels at a profit to itself and a fair return to the Government. About fifty invitations were issued by Paymaster General Potter to attend this conference.—*Army and Navy Register*, 10 December, 1921.

GUAM AS A NAVAL BASE.—To the Editor of *The Tribune*.—Sir: Will you kindly permit me to point out that the belief expressed by some writers in the great strategic value of Guam rests upon two fundamental errors?

1. One error is the belief that it would be possible to develop Guam into an adequate naval base. The insuperable difficulty in doing this is that Guam is not large enough. Its total area is only 210 square miles. If Guam were dropped bodily into Manila Bay, Chesapeake Bay, Long Island Sound or Puget Sound there would be plenty of water left all around it. If the whole island could be dug out and made into a harbor of quiet water the harbor would not be too large for the uses of a modern fleet in war, because it would have to be able to hold not only the fleet, but supply vessels of all kinds, and be equipped with numerous great repair shops and a number of drydocks. These drydocks would have to accommodate many different kinds of vessels, such as battleships, battle cruisers, submarines, supply ships, etc. One dock, no matter how large, would not be enough, because a single seriously wounded ship would monopolize it for several weeks.

2. The second error is the belief that even if it were possible to develop Guam into an adequate base it could be effective in assisting a fleet setting out from it to recapture the Philippines. Guam is too far away from them. Guam is 1,500 sea miles from Manila by one route and more than 1,700 by another route. Imagine a mined or torpedoed ship having to steam 1,500 sea miles to get into drydock! Realize that our

ships would be exposed to mines and to torpedoes, launched from planes and submarines, just as soon as they reached the vicinity of the Philippines, and in a greater degree when they tried to pass through the straits and bays with which the archipelago is filled. All the routes to Manila would be through waters ideal for the use of mines, submarines and torpedo planes.

Remember that the British Grand Fleet found it impossible to operate against Germany's coast; not because of the German high sea fleet, but because of submarines and mines. Remember, also, that the British fleet had several bases and drydocks, of the best possible kinds, only *300* or *500* miles away, across the comparatively smooth North Sea.

As a base for operations in the Far East the Philippines are incomparably better than Guam. Not only are they five hundred times as large, but they possess scores of fine bays and harbors, especially the Bay of Manila. *If the Philippines were equipped with adequate air forces no enemy could land in them.* In case they were threatened our fleet would find little difficulty in advancing to assist them, because it would be superior to any probable enemy that would try to stop it.

Whether the enemy occupied Guam or not would not make any great difference, because Guam is too small to help an enemy materially—especially an enemy whose home bases and drydocks were not far away.

BRADLEY A. FISKE,
Rear Admiral, U. S. N. (Retired),
Washington, D. C., Dec. 13, 1921.

—*New York Tribune*, 16 December, 1921.

FOUNDERED SUBMARINE RAISED.—The *S-48*, the new submarine which came to grief on her builder's trial run December 7, was raised Tuesday from the bottom of Long Island Sound where she was resting. She was brought up by means of chains slung between two lighters and was taken to the Lake Torpedo Co.'s yard for inspection as to the amount of damage inflicted.

From a naval officer on submarine inspection duty we learn some of the details of the thrilling experiences which the members of the crew underwent when the submarine was sunk. The vessel was in charge of Mr. J. E. Austin, operating manager of the Lake Torpedo Co., and was enroute to New London to make her deep surmergence test, required to determine that she can withstand the submerged sea pressure to which she may be submitted during her lifetime.

"Just outside of the harbor," says this officer, "preparations were made to hold a dive and a short submerged run, after which it was planned to bring her to the surface and proceed on engines to New London, where the deep dive was to have been held.

"When the orders were given to open the various flood valves which permit the water to enter the ballast tanks and submerge the vessel, water rushed into the ballast tanks, and it is thought that one of the small access holes to one of these ballast tanks was left open, or gave way, and permitted the water to enter the hull of the boat proper. The water rushed in through this opening into the engine room at such a high rate of speed that it was impossible to close the flood valves to the affected tank, with the result that in a very short time the engine room and the motor room abaft it were completely flooded with water. The crew of the boat had barely time to close the water-tight door between the engine room and the forward part of the vessel to save themselves, and the after section of the vessel was segregated by closing the engine room water-tight door. The problem then presented to the men on board was that of getting the vessel to the surface. The amount of water in these after compartments represented much more than that which was in the tank

and available for pumping overboard, so that it was immediately realized by those in charge that when all available water was removed the vessel would still be so heavy as to not rise to the surface."

From accounts given by the members of the crew on board the main electrical motors were immediately grounded, all the lights were grounded, and the boat was left in total darkness. Coupled with this, some of the water flooded over the ventilation piping of the engine room into the main storage batteries of the vessel and caused the generation of the deadly chlorine gas. Combatting this gas became a matter of immediate import to save the lives of all hands, and it is reported that at this junction M. A. Fritz, chief electrician's mate, U. S. Navy, who was one of the naval inspectors on board the vessel, took charge of the fight against the chlorine gas and cut the battery hose into short lengths and syphoned the salt water from the battery tank into the after part of the vessel. These herioc measures, assisted by bailing with coffee pots and other small containers, helped to cut down the amount of salt water in the storage batteries and thus reduce the amount of chlorine generated.

While the civilian crew of the vessel, who were totally unfamiliar with such a chlorine problem, turned to with a will under the able direction of Chief Fritz, the operating manager, assisted by Lieutenant Commander W. S. Haas and Lieutenant F. A. Smith, the officers on board, tried out the various means to empty the ballast tanks and full tanks of their contents to give the boat the positive buoyancy to permit her to rise to the surface.

The dummy torpedoes carried in the torpedo tubes were fired over the side with markers attached to tell the world the plight of the vessel. The radio mast was run up to mark the scene of the wreck to any passing vessel. However, after all the water was pumped overboard, it was still observed from the depth gages carried in various parts of the vessel that the bow was still under water. At this point the only means for further lightening the vessel were found to be about five tons of pig lead carried in the torpedo room to cover certain weights which were not actually on board.

This pig lead was, piece by piece, put in the chamber of the sounding machine and dropped through the bottom of the vessel. The reward for this arduous labor was to note the vessel's bow rising inch by inch to the surface until, after being surmerged eight hours, just at dusk the depth gages in the boat read "zero."

On opening the torpedo tube the crew were rewarded with noting that the outer door was above water. Mr. Peter Dunne, one of the company's employees, then crawled through the outer door to the upper deck of the vessel. He attached a line to the deck and, returning by the same route, advised his imprisoned mates of the status of things on the upper deck. Three men then went out on the deck, and mattresses, pieces of wood and clothing on board were passed up to the top side and a fire lighted to attract the attention of passing vessels. This was kept up for five hours, when the Standard Oil Co.'s tug No. 28, in command of Captain Eugene Olsen, sighted the fire and, thinking it was a motor boat on fire, came over to investigate.

The tug picked up all the members of the crew, who one by one, came through the torpedo tube, and took them to New York, where they received treatment at the naval hospital. Chief Electrician's Mate Fritz, to whom in a great degree the crew owe their lives, was found to be suffering from a very severe case of chlorine-gas poisoning, as was also Lieutenant F. A. Smith, U. S. Navy. The other members of the crew suffered to a certain extent from exposure.

The naval personnel on board were officers and men who were slated for duty in the vessel after she went into commission, consisting of

Lieutenant Commander W. S. Haas, commanding; Lieutenant F. A. Smith, executive; Chief Torpedoman J. F. Cullinane, and Chief Electrician's Mate M. A. Fritz.

The *S-48* lay in about 70 feet of water some four miles outside of the harbor of Bridgeport, with about 20 feet of her bow extending out of water at an angle of about 20 degrees.

The *S-48* is about 1,000 tons displacement, propelled on the surface by two Busch-Sulzer Bros. Diesel engines; she is 240 feet long and of double hull construction and had on her the latest equipment of current submarine design.

The submarine *S-48* was raised and towed to the harbor of Bridgeport, Conn., on December 20, where the Lake Torpedo Boat Company is proceeding with the work of placing her in operating condition.

The *S-48* was under water for practically 13 days. The final stages of the salvaging operations consisted in pumping the water from the motor room, and then, after taking the strain on the stern of the vessel between the two 250-ton barges, *Monarch* and *Century*, pulling the stern out of the mud and holding it in flotation while the vessel was towed into the shoals in the harbor of Bridgeport. After this the vessel was pumped dry with comparative ease, and the work of cleaning up the interior and overhauling the machinery as required is going forward. It will probably take about two months to put the vessel back in good running condition.—*Army and Navy Register*, 24 December, 1921.

MEN AND SHIPS.—In view of all that has been heard about the supremacy of the human factor in war it is rather surprising that the American proposals for naval limitations take no cognisance of personnel. Apparently it is intended that the Powers affected by the agreement shall decide for themselves how many officers and seamen they are to keep in service, and this seems the wisest arrangement to make. Any attempt to ration the naval man-power of each nation would scarcely be practicable, for the conditions vary in each case. Japan, for instance, maintains a personnel abnormally large in proportion to her establishment of ships, especially in the commissioned branches. The reasons for this are explained by the Japan "Year Book" as follows:—"Differing from the system followed in England, the Japanese Admiralty organizes its fighting staff by holding a full complement of active officers in readiness to meet all emergencies. This is the reason why our navy is apparently overstaffed as compared with that of England. The English fleet, which totals about 2,330,000 tons, has a staff of 3,111 officers, from midshipmen to flag officers. The corresponding figures for our fleet are 650,000 tons and 2,190 officers. Reduced to a per ton rate, the English fleet has 1.35 officers against 3.42 for Japan." At the present moment both the British and American navies are undermanned. In our case the deficiency is due to lack of funds. We could get plenty of men if money were available for their training and keep. But in the case of America the difficulty is to get the men. A year ago the U. S. Navy was declared by several of its admirals to be on the verge of disaster through shortage of trained men.

We have heard it suggested that one reason why America has proposed to scrap 15 of her uncompleted capital ships is that she knows it would be impossible to man them even if they were completed. This seems to us a far-fetched theory, though there may be grain of truth in it. What effect the adoption of the American disarmament scheme will have on our own personnel remains to be seen. Recruiting for certain branches has already been suspended, but similar action has been taken on previous occasions, and the Admiralty deny that the present step is connected with negotiations at Washington. Still, it is obvious that if practically all the reserve ships are to be done away with, and no new capital ships are to be

built for ten years, the Navy's personnel will have to be reduced below the present figure. The scrapping of valuable ships is serious enough, but the loss of highly-trained ranks and ratings would be infinitely more so. A capital ship may be put together in two years, but it takes at least thrice that length of time to turn out a capable man-of-war's-man.—*Naval and Military Record*, 30 November, 1921.

PAY PROPOSALS BASED ON LENGTH OF SERVICE.—The report that the Wadsworth Joint Congressional committee will make to Congress on the readjustment of pay in the Services is forecast in a memoradum prepared by Representative John C. McKenzie, of Illinois, which is now being studied in the War, Navy and Treasury Departments. Boards of officers from the Army, Navy, Marine Corps, Coast Guard, Public Health Service and Coast and Geodetic Survey are carefully analyzing Mr. McKenzie's prosposals with a view to reporting the result to the Joint Congressional committee.

It is a comprehensive plan which would completely readjust the pay of the Services. The basic principle is that officers' pay should depend more on length of service than on time in their grades. It also introduces the principle of making an allowance for extra pay to officers who have dependents. The heat and light commutation allowances are simplified and given elasticity by allowing the President to adjust them to the cost of living. The boards which have been appointed to make a study of the McKenzie plan are holding night sessions.

Believed Bill will Pass

It is understood that Mr. McKenzie has taken the proposition up with the leaders of the House, and has canvassed the general legislative situation. He is convinced that it will pass the House, where is has been anticipated all along the most opposition would be encountered in securiny any legislation for the continuation of the present rate of pay. The merit of the proposition to the economists is that it will not increase, and may decrease, the appropriations for pay of the Services. In some quarters, it is insisted that a saving of three million dollars in the pay of the Services will result from the adoption of the McKenzie plan.

In outlining his plan to the Departments, Mr. McKenzie submitted a memorandum, which we quote in part:

"The pay schedule for officers of the Services should be based on the length of time officers have served rather than exactly on the grades in which they happen to be serving; and some distinction should be made in amount of allowances granted to officers with dependents and those without. I have come to the conclusion that a permanent pay schedule should be arranged on such a basis as to introduce a sort of sliding scale so that the amount received by an officer might be changed from time to time by Presidential order to meet the changing conditions in cost of living.

Elastic Schedule Proposed

"I believe there should be established for the officers a pay schedule which should be fixed in amount based on length of service, and entirely independent of family or of dependents; that to this base pay should be added certain allowances in the form of commutation of rations and commutation of quarters, which allowances should, to some extent, be based on dependents and should be subject to some degree of elasticity. I would divide the officers of each Service into, say, six groups, along such lines as follows:

"Those serving in the first four years of their commissioned service, in first group; those serving from beginning of fifth year, to end of eleventh year of their commissioned service, in second group; those serving begin-

ning of twelfth to end of seventeenth years, third group; eighteenth to end of twenty-third year, fourth group; twenty-fourth to the end of thirtieth year, fifth group; and those with more than thirty years' service in sixth group. I have made six divisions to correspond with the six grades from second lieutenant to colonel, inclusive.

"Since an officer's value increases with his training, his experience, and professional development, I would start the young officer just commissioned with say $1,000 a year as base pay, gradually increasing that to $6,000 a year when he has completed thirty years' commissioned service.

Dependents Provided For

"Under the present law when an officer changes stations transportation is furnished his dependents, and to an officer at sea, or in the field, commutation of quarters is furnished his dependents. I would extend this principle slightly, to every officer an allowance of one ration, to an officer with one or two dependents, an allowance of two rations; to an officer with three or more dependents, an allowance of three rations; to an officer not furnished public quarters I would give commutation, based both on length of his service and on his dependents. I would divide the officers so as to include in one group the first three classes noted above (those of less than 18 years' commissioned service) and those of the last three classes in the second group (those of more than 17 years' commissioned service). To the first group not occupying public quarters, without dependents, I would give commutation of rent for one person for one month; to those with one or two dependents, I would give commutation of quarters for two persons for one month; to an officer with three or more dependents, I would give commutation of quarters for three persons for one month. To the officers in the second group who have no dependents, I would give commutation of quarters for two persons for one month; to those with one or two dependents commutation for three persons for one month; to those with three or more dependents commutation for four persons for one month.

"To meet changes in cost of living, I would fix the limit within which the President might exercise his discretion in fixing amount of commuted value of rations (say not less than twenty-five cents nor more than one dollar) and amount of commutation of quarters for one person for one month (say not less than $15 nor more than $30). To an officer who enters or has entered the Service in a grade above that of second lieutenant (or corresponding grades in other Service), I would give for purpose of pay only constructive service equal in amount to that specified in the Army Reorganization act for promotion in the Veterinary Corps; that is three years for first lieutenant, seven to captains, fourteen to majors, twenty to lieutenant colonels, and twenty-six years to colonels.

Service in War and to Date

"In order to reconcile the differences in length of service of those officers who entered the Army during the war I would favor giving to all persons who served as commissioned officers of any of these services at any time between April 6, 1917, and November 11, 1918, whose original entry into the Regular Service (whether Army, Navy, or Marine Corps, etc.) was subsequent to April 6, 1917, credit for continuous service from April 6, 1917, to the date of the passage of this act, except as specifically stated in the act. I would allow no service to be computed for determining an officer's pay except commissioned service rendered under a Federal commission; in other words, service as a candidate for a training camp, as a federally recognized National Guard officer, as a cadet at either the Military or the Naval Academy, or any similar service, would not be

computed in determining an officer's pay. To those officers whose promotion is limited by law to any grade below that of colonel (or the corresponding grade in the other services), I would limit their maximum pay to that determined by the limitation in promotion. For example, the pay of the officers of the Medical Administration Corps of the Army whose promotion is limited to that of captain, would be limited to that of officers serving between the beginning of the twelfth and the end of the seventeenth year.

"To officers who fail in examination for promotion to next grade, and to those passed over for promotion by a selecting board, and those reduced by reason of sentence of a court-martial, I would deny an increase of pay during their suspended promotion. I would abolish all existing laws which authorize longevity pay and commutation of quarters, heat and light, and all laws which authorize an increase of pay for foreign service and for sea duty. To officers actually on duty in the field or dependents at home, I would allow commutation of quarters for the dependents, not to exceed three in number, but not for the officer himself. I would limit the dependents to a wife, a boy under age of twenty-one, unmarried daughters of any age, and invalid son of any age, an officer's mother or father, or invalid brother or sister dependent upon him for support."—*Army and Navy Journal*, 10 December, 1921.

CHANGES IN PROSPECT FOR NAVAL RESERVE.—Secretary Denby has before him the report and recommendations submitted by the board of naval officers, headed by Rear Admiral Thomas Washington, chief of the bureau of navigation, appointed some weeks ago to consider the changes which should be made in the laws governing the naval reserve force. While no announcement will be made of the contents of this report until it has received the sanction of Secretary Denby, it may be surmised that it will contain a plan for the rehabilitation of the citizen reserve along the lines of the National Guard and with a system of payment for services rendered in drill periods, which will be practically identical with the Army reorganization act. Such a plan will doubtless meet the desire of Mr. Denby, who was quoted in these columns some weeks ago as favoring the reëstablishment of the naval militia as a naval reserve organization, with the joint support of the states and of the federal government. No retainer will be paid to the members of this force, but they will receive the pay of their grade when on active duty or in training. It is probable that three classes will be recommended, the first being the fleet reserve, composed of ex-Navy people, and the members of the present class 2, or sea-going officers and men; the second being the citizen reserve patterned after the National Guard, as described, and the third the volunteer reserve, which will likely remain much as it is now constituted, with no requirements for drills and no pay or retainer whatsoever. As for the fleet reserve, which is of greatest interest to regulars, it is a foregone conclusion that the strong objections raised by Chairman Wadsworth and other members during the pay hearings last week will be met and the generous retainer incomes now being paid will be substantially reduced, both for officers and men.. Recommendations may be expected to eliminate altogether in future the 16-year class of enlisted reservists, who now draw in the neighborhood of $60 a month retainer, and a reduction in the retainer which will be drawn by future members of the 20-year class. Recognition will doubtless be asked of the fact, well known in naval circles, that greater efforts are needful to keep a naval reserve intact than would be necessary for an Army reserve, as the organization units are much further apart in the interior, and a greater need exists for drills in the duties of a man-o'-warsman, which must be conducted at a naval station. As men scatter to the inland states after completing their active naval service, entering civil occupations, special

facilities must be provided for them to drill under naval conditions, even though the nearest naval station may be hundreds of miles distant. Another recommendation which may be predicted is that officers in the new plan will receive commissions in the reserve which will continue in force until revoked by proper authority instead of the present requirement of re-enrollment of all officers every four years. The four-year period of enrollment greatly increases the paper and administrative work without corresponding advantage to either the government or to the individual. A reserve officer, under the new plan, would hold his commission at the pleasure of the Department, or, in plainer language, so long as he met the requirements and his services in his grade may be needed. A limitation will probably be placed upon the citizen reserve, perhaps in the neighborhood of 60,000, with possibilities of rapid expansion in event of threatened hostilities. During the recent session of the representatives of the reserve officers' association in Washington frequent conferences were held between the reservists and the members of the Navy board, and the salient features of the board's recommendations were fully discussed, and it is presumed that the plan of reorganization has been accepted as satisfactory by the reserve officers. During their stay in Washington they came to realize the necessity of curtailing governmental expenditures and they recognize now what many naval reservists did not recognize before—the futility of any attempt to obtain continued appropriations for the payment of large retainers to members of the reserve merely to hold themselves in readiness for naval duties in time of emergency.—*Army and Navy Register*, 10 December, 1921.

ANALYSIS OF MCKENZIE PAY PLAN.—The serious consideration which is being given to a substitute for the service pay provisions of the act of 1920 render important at this point in the discussion of service compensation a further analysis of the plan suggested by Representative McKenzie, vice-chairman of the special committee. During the hearings on the readjustment of service pay at the session of December 2 Mr. McKenzie, in presenting his plan to General Pershing, called attention to the fact that the special committee then sitting had several courses open to it. In the first place, he said, the committee could recommend a continuance for one or two or three years of the present temporary increase, or it could take no action whatever, dodge the responsibility, and let the law expire by limitation on the thirtieth of June next, thereby letting the pay revert to the 1908 schedule. But, he said, knowing the chairman of the committee as he did and the other members of the committee, he thought he was safe in saying that the committee would not be content to follow the line of least resistance, but that it would endeavor to solve some of these vexatious problems that have been confronting Congress and the services for many years. He felt that the problem concerning pay was one that required very careful study and a complete readjustment of the pay of the services along sound lines that would be in the interest of both the government and the services. In the statement which he then presented to General Pershing he enunciated three general principles as the foundation upon which to build the readjusted pay schedule: First, to make length of service the controlling factor in determining the base pay of officers; second, to provide for a sliding scale by the introduction of elements which will increase or decrease the total compensation of officers as the cost of living increases or decreases; third, partially to base the allowances of officers on the number of dependents that an officer is called upon to support.

Under the present pay schedule the base pay of officers is determined both by the grade in which the officer is serving and his length of service. Mr. McKenzie's proposition would abandon the principle of basing an officer's pay on his grade. The question as to whether or not this is sound in principle immediately arises. Grade and rank in an Army existed

before pay. Rank was originally instituted for purposes entirely separate from the matter of pay. It was instituted for purposes of discipline, precedence, prestige and as a function of command. Some time or other in the history of armies an officer's pay was made dependent upon the grade which he held. Undoubtedly there was a good reason for doing this at the time it was done. In our Army a few years ago an officer's responsibility was determined almost entirely by his grade. Such is not the case at the present time. An officer's responsibility at the present time is determined by his assignment, and his assignment is determined primarily by his qualifications, secondarily by the grade in which he is serving. Of course, in some cases, as, for instance, in a tactical organization such as a regiment, battalion or company, an officer's grade is the determining factor in his assignment, but in the great majority of cases his qualifications are the determining factor, and his grade has little to do with it except as grade tends to determine qualifications. For example, an officer on duty in the War Department is assigned to duty in accordance with his qualifications and his assignment is rarely changed when he is promoted to a new grade. His responsibilities being fixed by his assignment are the same after promotion as they were before promotion. This can be very definitely illustrated by referring to officers on duty as instructors at the various service schools. For example, take a department at West Point. Members of the class of 1916 in the grade of major, drawing the pay of majors with one fogie, are serving alongside of and performing the identical duties with members of the class of 1917 who are serving in the grade of captain and drawing the pay of that grade without any fogies. The responsibilities of these officers are identical and their qualifications are practically the same in spite of the fact that they are widely separated in rank. The question naturally arises should their pay be the same?

The idea that basing pay upon length of service puts officers of Army or Navy in a class of pensioners or time servers, as has been suggested, is not only absurd, but is absolutely inconsistent with the facts. Under existing law an officer who commits a crime is court-martialed and dismissed; if he is physically disabled he is removed from the active list, and if he is otherwise unfit to perform the duties of an officer he is placed in Class B and thereby removed from the active list. Existing law requires that the qualifications of every officer in the Army be inquired into every year. There is no class of persons in this country whose mental, moral, professional and physical qualifications are inquired into as carefully, as rigidly and as often as are those of officers of the Army. Any officer who gets by all these annual tests and becomes merely a time-server in the government service does so because the War Department is derelict in its duty.

Providing a sliding scale by means of which an officer's compensation may be increased or decreased according to the cost of living is completely new in our system of pay for the services, but everyone seems to feel it is eminently fair and based on sound economical grounds. It brings out very clearly the point that, generally speaking, an officer is not paid for his services, but is paid on the principle of maintaining him in a position where he can enjoy the comforts of a decent living without being harassed by financial worries, no matter what the cost of living may be. In other words, it brings out clearly the principle on which the compensation of officers of Army and Navy is based.

The commissioned officers of the Army constitute an institution maintained by the government in time of peace and trained in their profession for the purpose of responding to the federal needs in time of an emergency, whether that emergency be in the nature of a strike in Colorado or West Virginia, an earthquake and fire in San Francisco, a flood in the Mississippi Valley, an insurection in the Philippines, a Boxer uprising

in China, a threatened revolution in Cuba, an expedition into Mexico or a world war. It is for the purpose of meeting these emergencies that the government maintains the commissioned officers of the Army. The service that these officers render in time of peace is never evaluated in terms of dollars; in fact, their service is never evaluated in such terms even in times of emergency. In this respect Army officers are on an entirely different basis from persons engaged in practically every other profession or occupation. In civil life a man's services can be evaluated from time to time in terms of dollars and cents. For example, a day laborer's services can be evaluated every night. The president of a corporation's services can be evaluated from time to time, possibly once a year. The government, on the other hand, has no means by which the service of officers of the Army or Navy can be evaluated in terms of dollars and cents. The officers of the regular service constitute an insurance that the government is maintaining for the purpose of meeting the federal needs in time of emergencies. The theory on which the government pays these officers is that they shall have enough to maintain them so they can prepare themselves to meet these emergencies. Every boy who goes into the Army certainly understands that the character of the service in the Army deprives him of any opportunity to engage in any sort of business or professional activity for the purpose of accumulating money. He does not necessarily make a financial sacrifice when he goes into the Army, but he does understand thoroughly that when he starts his career as an officer of the Army he gives up the opportunity to accumulate anything more in the way of money than comes to him through his government salary. The very life which he must lead makes it absolutely impossible for him to engage in any kind of money-making business, and the government expects and demands that he shall not divert his time, his energy or his ability from the military profession into other channels. Therefore, the theory on which the officers are paid is not that they are performing a service which is being evaluated and for which they are being paid in accordance with that evaluation, but it is on the theory of maintaining them in time of normal conditions so that they will be ready instantly to respond to the federal requirements in time of an emergency, no matter what those requirements may be. It is for this reason that the compensation allowed officers should have in it this element of a sliding scale, which makes it possible to adjust the compensation on the basis of the cost of living.

It is because of this same principle, namely, that the government is maintaining the officers of the service for possible future emergencies, which makes it necessary to provide a greater allowance for officers with dependents than for those without dependents. The fact that dependents have a direct bearing on the manner in which officers perform their service has been recognized by the government for many years. It was because of this fact that extra pay for foreign service and for sea duty was authorized. At the time of this authorization the government realized that the officer in the Philippines or at sea had to maintain two establishments, one for himself and one for his family at home, and it was partially to meet the requirements of maintaining these two establishments that the 10 per cent increase was authorized. The Army, when stationed on the border, where there were no quarters for families, realized for many years that something should have been done in the way of commutation so as to provide a place to live for the family of an officer on the border. When the World War broke out and all the people of the country became involved in it the fact that dependents had such a decided and controlling influence on the manner in which persons engaged in the military service perform their duties prompted Congress early in the war to pass laws providing for family allowances and for commutation of quarters to officers in the field with dependents at home. Later, in 1920, the fact that the cost of transportation of an officer's dependents was a matter of having a very im-

portant bearing upon his services (made it necessary generally for the officer to borrow money to move his family every time he changed station), prompted Congress to provide in the act of May 18, 1920, for their transportation at government expense. If the fact of dependents is not to be taken into consideration in fixing an officer's compensation, then, under the theory on which officers are paid, that is, that they are being maintained by the government for use in emergencies, the pay schedule of 1908, as Mr. McKenzie has stated, is sufficient for the officer alone. Under the McKenzie plan the base pay of an officer, his own subsistence allowance and his own allowance for commutation of quarters are entirely independent of and have no connection with dependents. It is only when the officer has persons dependent upon him for support that the plan increases the allowances to meet the requirements of those dependents. In other words, if dependents are not to be taken into consideration, the base pay, the subsistence allowance for one person and the commutation allowance for one person and the commutation of quarters for one person are, it is claimed, sufficient to meet all requirements.

Practically all the testimony given before the special committee (nearly 500 pages of fine print) shows that a compensation greater than that authorized in the act of May 11, 1908, is necessary because under that pay schedule an officer cannot support a family. There was no evidence brought forward to show that the 1903 pay schedule was insufficient to meet the requirements of a single person without any dependents. In view of this situation, it is necessary to make the compensation of officers who have dependents greater than the compensation of those without dependents, or else it is necessary to make the compensation of those without dependents too much for their needs in order to make the pay of those with dependents enough for their needs. No other conclusion can be drawn.—*Army and Navy Register*, 24 December, 1921.

SHIPS OFFICERS ACCEPTING POSITIONS AS ABLE SEAMEN.—Officers created by the war in the American merchant marine are rapidly being forced by lack of employment to return to the fo'c's'le as stewards or even able seamen. This is the observation of Dr. George Sidney Webster, Secretary of The American Seamen's Friend Society, who says:

"It is surprising to note at the Home of The American Seamen's Friend Society the increasing number of men having served as officers during the war who are now obliged to return to the engine room or steward's duties—in many instances even the duties of an able seaman. Many of these men were graduates of navigation schools and received thorough training for their duties as officers. They composed some of the men who in recent years would reserve their room by wireless at the Society's quarters before their arrival in the Port. Today they are sleeping in the dormitories with other seamen.

"Most of these men are either American born or naturalized and it is a pity that the training which they have received as officers cannot be used to its full range. Of course some of the men who have received this training have already left the sea, but most of them have remained with the job that is regarded by them as a life work. To be living again in the fo'c's'le after a period on the quarter deck is something of a test to any sailor. However, it is a matter of pride to us to observe the faithfulness of these men to the sea."—*Nautical Gazette*, 24 December, 1921.

STANDING OF U. S. PORTS.—Much has been published at various ports relative to the importance and standing of their particular ports, and figures have been printed to substantiate their various claims. One port will dwell on total tonnages of vessels entered and cleared regardless of whether they are in ballast, partly or fully laden or merely touching at an intermediate port; another will produce figures of actual long tons discharged or laden (which is mere guesswork, as such figures are not obtainable from official

customs records), while another will use the official customs statistics of values of imports and exports.

The last mentioned method is the more nearly correct way to compare the various ports, namely, by values of imports and exports, particularly by imports, says the *Commercial News* of San Francisco. Judged in this manner, the relative standing of the principal ports of this country is as follows:

Port and Rank	Total Imports and Exports
1. New York	$6,176,494,431
2. New Orleans	986,453,444
3. Philadelphia	724,412,853
4. Galveston	679,982,468
5. Boston	584,554,985
6. Detroit	463,570,906
7. Baltimore	451,380,973
8. San Francisco	437,756,058
9. Norfolk	331,729,622
10. Seattle	326,958,481
11. Ogdensburg	288,109,225
12. Buffalo	259,365,795
13. Savannah	256,283,030
14. St. Albans	154,648,958
15. Tampa	146,583,788

—*Nautical Gazette*, 27 December, 1921

AQUITANIA'S INCREASED SPEED.—Since the Cunard liner *Aquitania* has been converted into an oil burner, her speed has been considerably increased. During the last portion of her eastbound voyage from New York which ended in Southampton on November 21, she attained a speed of 26.66 knots. With the exception of the *Mauretania*, no ship afloat has ever equaled this speed. Much interest has been aroused as to the possibility of new records being made by the *Mauretania* and the *Berengaria* which are being converted from coal to oil burners.—*Nautical Gazette*, 24 December, 1921.

BOARD OFFERS SHIPS SUITABLE FOR DIESEL ENGINES.—According to an announcement by Admiral Benson, the Shipping Board has decided to offer for sale 20 of its ships to such purchasers as will agree to install Diesel engines in these vessels. Ten of these will be of the Great Lakes type and two each of the 7,200 deadweight ton type, 8,400-ton, 9,400-ton, 10,000-ton and 12,000-ton types.

"We have long recognized the prime necessity of developing Diesel engine driven tonnage if this country is to take its rightful place as a maritime nation," Admiral Benson said. "At present day costs this installation in a 10,000-ton vessel will amount to around $500,000. Sales of Diesel tonnage have been made abroad as low as $60 a deadweight ton, but the going rate today is probably nearer $80.

"The Board unanimously believes that in this action it is carrying out three important provisions of the Merchant Marine Act—first, placing of its tonnage in private hands; second, providing the most modern type of vessel for service under the American flag, and, third, giving work to American shipyards at a time when their business is at very low ebb."—*Nautical Gazette*, 10 December, 1921.

BOARD'S MONTHLY LOSSES REDUCED.—Losses of the Emergency Fleet Corporation totaled $3,954,000 in October as against $5,000,000 in August and more than $6,000,000 last June, when the new Shipping Board took office.

The payroll as of November 18 was given as $10,993,000 compared with $15,861,000 on June 15—these figures being on an annual basis—a decrease of $4,868,000 in five months. There are now 1,300 ships tied up, as compared with 956 in June according to the report.—*Nautical Gazette*, 10 December, 1921.

BRITISH AND U. S. MERCHANT STRENGTH.—According to Chairman Lasker of the Shipping Board, considering only passenger ships and combined passenger and cargo ships of 8,000 tons and over which represent the very cream of the world's merchant marine convertible for naval purposes, Great Britain possesses 234 ships of this type already completed, and the United States possesses 54 ships, or a ratio of 4.3 to 1 in favor of Great Britain. If vessels now actually building in both countries of this type be taken into consideration, the ratio in favor of Great Britain is 5 to 1.

When speed is considered, and speed is essential for naval purposes, the ration is even more startlingly in favor of Great Britain; as of vessels of 22 knots and over she possesses 5, the United States possesses only 1, or a ration of 5 to 1; in all vessels of 12 knots and over, which is the minimum speed useful for naval operations, she possesses 234, and the United States possesses only 53, or a ratio of 4.4 to 1 in favor of Great Britain.—*Nautical Gazette*, 17 December, 1921.

ISHERWOOD SYSTEM STANDS UP UUDER SEVERE TEST.—In tow of two wrecking steamers the oil carrier *F. D. Asche*, owned by the Standard Oil Company, arrived at New York on December 1 after having been towed from the Bahamas without any bottom. The vessel met disaster in the cyclonic storm of late October after leaving New York for Texas City. She is a steel vessel of 12,000 tons deadweight built by the Newport News Shipbuilding Company in 1918, and was swept out of her course and piled up on the treacherous reefs of the Bahamas. She climbed over one reef only to lodge on another, where she remained fast, her forehold deck level with the sea in 5½ fathoms of water and her entire bottom practically ripped off.

Owing to the fact that the vessel is built on the Isherwood System of longitudinal construction of ships, the hull withstood the strain of the perilous position in which she lay on the rocks. Captain McKenzie and his crew remained on board the steamer and were able to use the donkey boiler and donkey engine to maintain their radio communication and also to provide their needs on board.

The wrecking steamers *I. J. Merritt* and *Willard*, of the Merritt-Chapman Wrecking Company, were sent to the asistance of the *F. D. Asche*. It was found, by the divers, that the hull of the ship, with the exception of the bottom, had remained intact and that she was susceptible, therefore, to being raised by means of compressed air tanks. After being raised and still kept afloat by the emergency compressed air tanks, the two wrecking steamers took the vessel in tow and brought her safely to New York.

The salvaging of the *F. D. Asche* is practically a duplication of the salvaging of the steamer *Curaca*, which was damaged in Halifax Harbor in the great dynamite explosion during the war. The *Curaca's* superstructure was blown away entirely and she was buckled to an alarming extent. But her hull held together, she having been built on the Longitudinal System, perfected by Sir Joseph Isherwood, and she was finally raised and towed to New York, where she was repaired at the Robins Drydock of the Todd Shipyards Corporation, the same yard that will now repair the *F. D. Asche*.—*Nautical Gazette*, 10 December, 1921.

BATTLE CRUISERS COULD BE MADE INTO FASTEST LINERS.—President Joseph W. Powell of the Emergency Fleet Corporation states that it is entirely feasible to convert the six American battle cruisers scheduled to be scrapped under Secretary Hughes' naval disarmament program into fast passenger liners. Each is 874 feet long, 101 feet beam, has a mean draft of 31 feet and a displacement of 43,500 tons. They include the *Constellation* and *Ranger*, at the Newport News Dry Dock and Shipbuilding Company's plant; the *Constitution* and the *United States*, which were to have been built at the Philadelphia Navy Yard; the *Lexington*, at the

Quincy yard of the Bethlehem Company, and the *Saratoga*, at the Camden plant of the New York Shipbuilding Corporation. The *Lexington* has been constructed up to the third deck, or just above the water line.

The cruisers were originally designed to make a speed of 34 knots and with their great boiler capacity, they could attain an economical cruising speed of 26 knots, Mr. Powell said, crossing the Atlantic in five days. The ships, after conversion into liners, might readily accommodate 1,000 first class, 1,000 second class and 2,000 third class passengers.

Mr. Powell does not believe it would be advisable to convert more than three of the vessels into passenger liners because that number would be adequate for the service. No estimate was made by him as to the amount of money necessary for changing the cruisers into passenger vessels, but he said it would be less than the cost of building new liners.

In local shipping circles not much stock is taken in this suggestion of Mr. Powell's. In an interview Mr. J. W. Stewart, American representative of Sir Joseph Isherwood, inventor of the Isherwood system of longitudinal framing which was adopted for the battle cruisers, pointed out some of the defects of the Powell plan.

"There are so many practical difficulties to be overcome and the expense of conversion would be so great that the vessels would prove a liability and not an asset," said Mr. Stewart. "As to the cost for making the necessary changes, I would say off-hand that they would be the equivalent of one-half the cost of building the ship. When completed they would be probably the most expensively built and most costly operated commercial passenger ships in the world.

The battle cruisers are too delicately constructed for the rough handling and continuous service to which they would be subjected as passenger ships. Placed on the seventeen trips a year schedule followed by the fast foreign liners, the constant drive of the engines, coupled with the grinding against piers and other rough usage, would result in time and money being lost for repairs.

"There is the further consideration that the boilers, being of navy design, occupy more space and require more expert handling than is considered economical on passenger ships. In general the design of the under deck compartments, together with the large amount of room taken up by the running gear, means a sacrifice of deadweight space. The tendency of passenger ship building today is all in favor of the vessel which can carry cargo as well as passengers. If it is true that substantial profits can only be shown by ships of this type, then the converted battle cruisers would obviously be unsuited to the conditions of competition that now prevail."—*Nautical Gazette*, 10 December, 1921.

NOVEMBER'S VESSEL OUTPUT IN DETAIL.—The Bureau of Navigation, Department of Commerce, reports 79 sailing, steam gas, and unrigged vessels of 61,509 gross tons built in the United States and officially numbered during the month of November, 1921, as follows:

	Atlantic and Gulf		Pacific		Great Lakes		Western River		Total	
	No.	Gross	No.	Gross	No.	Gross	No.	Gross	No.	Gross
WOOD										
Sailing	3	87	....	.....	....	.....	....	.....	3	87
Steam	....	.....	....	.....	....	.....	....	.....	....	.....
Gas	50	1,334	2	66	....	.....	4	61	56	1,461
Unrigged	3	1,230	2	156	1	325	....	.....	6	1,711
Total	56	2,651	4	222	1	325	4	61	65	3,259
METAL										
Sailing	....	.....	....	.....	....	.....	....	.....	....	.....
Steam	8	46,292	1	9,838	....	.....	....	.....	9	56,130
Gas	....	.....	....	.....	....	.....	....	.....	....	.....
Unrigged	3	2,108	....	.....	2	102	....	.....	5	2,210
Total	11	48,400	1	9,838	2	102	....	.....	14	58,340

Sailing	3	87	....	.....	....	.....	....	.....	3	87
Steam	8	46,292	1	9,838	....	.....	....	.....	9	56,130
Gas	50	1,334	2	66	....	.....	4	61	56	1,461
Unrigged	6	3,338	2	156	3	427	....	.....	11	3,921
Grand Total	67	51,051	5	10,060	3	427	4	61	79	61,599

The above total includes 32 rigged vessels of 880 gross tons and 5 unrigged vessels of 1,614 gross tons, total 37 vessels of 2,494 gross tons built in years previous to 1921. Of the above total 1 vessel of 14,187 gross tons was built for the United States Shipping Board. *This was the passenger and cargo carrier *Bay State*. The next largest vessel completed was the tanker *Wm. Rockefeller* of 14,054 gross tons constructed for the Standard Oil Company.

The following vessel, which is not included in the above statement, was built in this country for foreign owners during the month of November, 1921:

Rig.	Name of vessel	Gross	Owner	Flag
S.s	*Victolite*	10,396	Imperial Oil Co., Ltd.	Canadian

—*Nautical Gazette*, 24 December, 1921.

IDLE TONNAGE ABROAD.—According to latest foreign advices, ocean-going vessels of the following tonnage were laid up in ports of the countries hereinafter named:

Country	Gross Tons
Denmark	330,000
Sweden	366,000
Norway	851,635
Spain	452,000
Italy	790,000
Japan	250,000*
Great Britain	5,380,000*

* Deadweight.

—*Nautical Gazette*, 10 December, 1921.

AERONAUTICS

TRIALS OF HELIUM FILLED AIRSHIP C-7.—The U. S. Navy's non-rigid airship *C-7* is the first lighter-than-air craft in the world to make a flight inflated with helium gas.

The airship left the Naval Air Station at Hampton Roads, Virginia, at 6:37 A. M. arriving at Anacostia at 10:20 A. M. after going over the city. On her return trip she left the Air Station, Anacosta, at 12:03 P. M. again circling the city, and reaching Hampton Roads at 4:30 P. M. The flight was made without mishap of any kind.

Prior to this trip a thoroughly satisfactory flight of about forty-five minutes was made, followed by a second flight of about fifteen minutes duration. The performance of the airship on both these flights was excellent.

The crew for the initial flight was as follows: Lieut. Comdr. Zachary Lansdowne, U. S. N., commanding officer; Lieut. Comdr. R. F. Wood, altitude pilot; Lieut. A. T. Sewell, direction pilot; Chief Machinist Mate Ferris, engineer.

During the three flights of the airship *C-7*, no helium whatsoever was lost in operation by valving.

Advantages of Helium

The great advantage of helium gas over hydrogen is that it is not liable to explosions due to static or electric connections, of from ignition due to sparks from the exhausts of the engines. Probably the greatest disadvantage in the use of helium is its cost of production, its availability and its buoyancy, as compared to that of hydrogen. Hydrogen with 100 per cent purity and under standard atmospheric conditions has a buoyance of 70 lb. per 1,000 cu. ft. of air displaced, while helium under similar conditions has 64.4 lb. lift. When helium has lost purity and consequently lift on account of diffusion with air it can be put through a repurification process and used again.

The Navy maintains a helium plant at Fort Worth, Tex., where helium is extracted from natural gas by compressor systems. It is required that a plant of this character be located where there is an abundance of gas and also an abundance of water for cooling the numerous compressors. The natural gas, after passing through this plant, becoming a purer illuminating gas than before when it is then returned to the gas company for commercial use. The natural gas is first passed through lime which removes carbon dioxide; it is then liquified, leaving nitrogen and helium gases which are drawn off and further compressed thereby liquifying the nitrogen and leaving the helium which is drawn off and compressed into cylinders and placed in storage for shipment.

Naval Airship Types

The Navy has been operating single-engined airships mainly for training purposes; the envelopes for these small airships have capacities ranging from 84,000 to 95,000 cu. ft. with dimensions roughly of 162 ft. in length and maximum diameter of 33 ft., the height of the ships being 48 ft. These small types carry a crew of three men, machine guns or bombs and sufficient gasoline at cruising speed of 35 m.p.h. to carry Class B ships a distance of 927 miles, class E ships 672 miles and class F ships 1,227 miles.

The Class C ships are twin engined and especially reliable for patrol and convoy work. Their dimensions are, length, 192 ft.; maximum diameter of envelope, 41 ft. 9 in.; maximum height, 60 ft.; maximum width, 53 ft. 7 in. The envelope has a designed volume of 181,000 cu. ft. Their fixed weight ready to fly is 7,940 lb., leaving the balance for disposable weights, consisting of crew, gasoline, oil, navigating equipment, radio, food, drinking water, ballast, bombs, guns, etc. The 181,000 cu. ft. capacity gives a gross lift for pure helium of 11,656 lb., making 3,716 lb. of lift available for the above mentioned disposable weights as against 4,760 lb. with a hydrogen gas purity of 98.6 per cent.

Class C airships have two engines capable of developing 125 horsepower at full speed giving the ship a speed of 55 m.p.h.; at half power the ship consumes 134 lb. of fuel per hour. At cruising speed of about 45 m.p.h. this ship has a cruising range of 2,180 miles. They are designed with sufficient ballonet capacity to reach an altitude of 8,600 ft.

Naval airship operations up to the present time have been mainly convoy, patrol, and photographic flights; their primary military value has been in antisubmarine warfare. It is expected that with the advent of rigid airships into the Navy this field of operations will be greatly broadened in extensive scouting and reconnaissance activities. It is probable also that airships may prove their usefulness in high altitude bombing and spotting work. Due to an airship's ability to hover over one spot they are extremely well fitted for the work of locating floating or surface mines and destroying them.

Naval Value of Airships

The airship's greatest value to the Allies during the past war was in convoy work. It was particularly noticeable that a submarine would not

attack a convoy that was escorted by airships. The value depended not so much on their ability to detect a submarine previous to its attack on the convoy as on the certainty of the airship locating the submarine after a torpedo attack, and radioing its position to surface craft which would result in the destruction of the submarine by depth charges from either the airship or the surface escort.

An advantage of airships over other types of aircraft is their ability to fly safely in fogs, rain, or at night. In fact, the airship is infinitely more easy to handle at night or in a fog than on the average day, because of their great sensitiveness to the stability of the atmosphere.

Communications between airship and shore stations is maintained by homing pigeons and radio. The radio compass is used to aid navigation in that an airship can locate itself by radio compass bearings taken aboard the ship, or by getting bearings from radio compass stations.

Type C airships require both altitude and directional pilots. The directional pilot is placed in the front cockpit and operates the steering wheel, while the altitude pilots sit in the second cockpit in the fuselage and operate the gas and air valves and engine throttles. The mechanic and radio operator occupy the rear cockpit. On long voyages there would be three pilots, one mechanic and one radio operator, and all unnecessary equipment for that particular flight would be sacrificed for ballast. The ballast may be surplus gasoline or water. When water or gasoline is not discharged for ballast, sand is used. Gasoline is only used for ballast in cases of extreme emergency.—*Aviation*, 17 December, 1921.

THE C-7 TESTS.—Aeronautical experts agree that the three performances of the Airship *C-7* with helium gas were excellent in every particular. The later part of the Hampton Roads-Washington flight was made in a snow storm. Summed up, it can be said use of helium as a gas for the inflation of airships has been demonstrated beyond a doubt. Helium, with the exception of the fact that it is a slightly heavier gas, is superior in every other respect to hydrogen. In addition to the non-inflammable and absolutely inert character of helium it involves no fire risk whatsoever, the use of the gas is advantageous from the point of view of the operator as it does not expand and contract nearly as rapidly as hydrogen, a characteristic which makes for economical operation. The diffusion of helium is much less than hydrogen and especially through rubberized fabrics. During the three flights of the Airship *C-7*, no helium whatsoever was lost in operation by valving.—*Aerial Age Weekly*, 2 January, 1922.

ROMA CHRISTENED.—The 400-foot army airship *Roma* fought her way for five hours and a half against a head wind from Langley Field to Washington December 21 to be named and put in commission officially by Miss Fonrose Wainwright, daughter of the Assistant Secretary of War, who broke a bottle of liquid air on the prow of the dirigible.

Secretary Weeks, Secretary Denby and Senator Rolandi-Ricci, the Italian Ambassador, who participated in the ceremonies, waited for three hours in the chilling wind which blew from the northwest, for the ship to arrive. They were to have taken a flight in her over the city and to Baltimore with other invited guests, but the wind was rising steadily, and Major General Patrick, Chief of the Army Air Service, ordered the *Roma* back to her hangar at Langley Field as soon as she could be refueled.

The great dolphin-like craft arrived at Bolling Field at noon and departed at 2:30, scurrying home with the wind behind her, in two hours and forty minutes.

A crowd of guests and officers of the two air services awaited the arrival of the army's new semi-rigid, the largest lighter-than-air ship in this country, at Bolling Field from 9 o'clock, impatiently stamping their feet and trudging back and forth in an effort to keep warm. Aeroplanes left the field from time to time to search out the great ship, which was con-

tinually reported by radio as approaching from the southeast, but did not appear. Finally she was reported as over Alexandria, making slow progress against a stiff wind, with three of her motors frozen.

Suddenly in the southwest there appeared a great, dull-gray shape, scarcely distinguishable against the slate-colored sky. It was the *Roma*—a massive, fat dirigible, moving a little toward the east, slowly and majestically lifting her nose over the encircling hills. Gradually her bulk loomed up, and she swung toward the west, heading directly for the field, with her motors roaring deafeningly. Approaching quite low, she seemed barely to miss the trees and hangars as she pushed against the wind and finally, reaching the center of the field, put her nose down and slowly settled.

A door in the V-shaped keel, near the bow flew open and a great coil of rope dropped to the "handling" crew below. All hands took hold and slowly the great craft came to earth.

The wind, sweeping from the north and west, swung the great ship back and forth as the men strained at the rope, while stay wires with cables attached were dropped out of ports along the keel to other men who stood by to steady her. Leveling off, but under the blast of her propellers, she settled on her "bumpers" and was landed, but she never stayed still a minute, swaying back and forth and carrying the men clinging to the ropes with her.

Then followed the naming by Miss Wainwright, who stood on a step-ladder under the great curving bows as she broke the bottle of liquid air, which flew into a bluish-gray cloud of vapor as the glass crashed. The old ensign was then replaced by a new one presented by the Italians and hoisted high on the stern over her curious box-like rudder.

Speaking for Italy, where the ship was designed and built, Ambassador Rolandi-Ricca expressed his pleasure that America should have bought her, and Secretary Weeks, in accepting the airship for the War Department, said that the pleasure and opportunity were rather his, that the army should be so fortunate in securing a ship developed by the skill of Italian craftsmen.

Major J. G. Thornell and his staff of pilots and navigators were also thanked personally by Secretary Weeks for their successful trip, despite their handicap of an adverse wind and disabled motors.

After the naming the color presentation took place, Assistant Secretary Wainwright replying to Lieut. Gen. Giuseppe Vaccari, who spoke feelingly of the cordial relations between Italy and America as he presented the new American ensign for the *Roma*.

General Patrick then ordered the field cleared and the ship gassed and rebalanced for homeward flight. As the motors were tuned up the handling crew eased up on the hauling cable and the big ship rose slowly on an even keel.

As soon as she was clear of the field the "let go" signal was given and the cables were hauled up. She slowly forged ahead into the wind, turned to the southeast as she reached the edge of the field. At a height of a few hundred feet the engines were speeded up, and, assisted by the wind, she began her homeward trip at a high rate of speed, disappearing over the hills to the south.—*Aerial Age Weekly*, 2 January, 1922.

GERMANS TO BUILD ZEPPELIN FOR U. S.—Authorization by the Allied Council of Ambassadors for the construction by Germany of a Zeppelin of the L-70 type for the United States was regarded in official circles here as a distinct triumph for American diplomacy.

By virtue of that authorization Germany is permitted to go behind the terms of the protocol signed in Paris last June, which limited the size of airships she might build to 30,000 cubic meters capacity. The airship which Germany will build for the United States is to be of 70,000 cubic meters capacity.

The opposition of the European Governments was overcome by repeated representations by Ambassador Herrick that this country would not use the new airship for military purposes and that America was entitled to compensation in kind for the Zeppelin awarded this Government and later destroyed by Germany.

Under the decision of the Council of Ambassadors Germany will construct a Zeppelin of the L-70 type at the Friedrichshafen hangar, the only one in Germany large enough to permit the building of an airship of that size, and then will tear down the hangar and disperse the mechanics brought together to fabricate the air monster. The completed airship will be delivered to the United States in Germany without the expenditure of a single penny by this Government, it was stated, and then will be flown across the Atlantic by a crew of Navy Department aeronauts. Construction of the airship will be under the direction of a staff of American navy experts.

The German L-70 class of airship measured 743 feet in length, 48 feet longer than the British *ZR-2*, but having the standard German diameter of 78.4 feet. Their total useful load was more than 88,000 pounds, equivalent to 59 per cent of the total weight of these ships. The ships carried a crew of thirty men each. They were driven by seven Mayback engines of 290 horse power each, arranged in six power cars suspended below the belly of the ship, two being placed in the after car, giving a total horse power of 2,030, and developing a speed of over 80 miles an hour.

Announcement that the Government had obtained permission to construct a rigid airship in Germany was followed by the disclosure that two German aircraft engineers visited this country several months ago to study possibilities of a fast Zeppelin service between Germany, New York and Chicago.

The engineers were said to represent the Zeppelin Airship Building Company of Friedrichshafen and gave their names as Harry Vissering and E. A. Lehman. They were in frequent conference with Weather Bureau officials. It is learned that they discussed plans for a passenger and mail carrying fleet of Zeppelins to ply between Germany and America.—*Aerial Age Weekly*, 26 December, 1921.

FORTHCOMING AIR CONFERENCE IN ENGLAND.—The success which attended the first Air Conference which was held in London last year has led to the decision to told a second Conference at the Guildhall in February next, under the auspices of the Air Ministry. At the last Conference service questions occupied a good deal of attention, but it has been decided that the February gathering will be concerned mainly with the development of commercial aerial transport. All aspects of this question will be discussed, and it is an advantage that Lord Weir has agreed to preside over the technical sessions. Invitations to the Conference are being issued to all those interested in the development of air transport, and arrangments are being made for demonstrations by aircraft and for a visit to the Croydon aerodrome for an inspection of as many types of machines as can be got together for exhibition purposes.—*The Engineer*, 9 December, 1921.

NAVAL AVIATION PROGRESS.—The report of Admiral Moffatt, Chief of the Bureau of Aeronautics of the Navy, shows commendable progress for the past year in this branch of the nation's defenses. Perhaps the most outstanding fact in the report is the statement that naval and marine aircraft flew, during the fiscal year, a total of 2,511,055 miles. The notable flights of the year were those of the Atlantic and Pacific fleet air forces to the Panama Canal and return, the F-5L flying boats from Coco Solo, Canal Zone, to Cartagena, Colombia, and the Marine Corps' flight from Washington, D. C., to Santo Domingo City and return.

The question of developing a means for launching planes from battleships has apparently been successfully solved, and it will now be possible to provide all ships of the fleet with fighting planes as an answer to the menace of bombing aircraft.

The helium plant at Fort Worth, Texas, has been placed on a production basis, and recently we referred to the success of the flight of the dirigible *C-7*, inflated with this gas.

Progress has been made in the photographic department, and during the year a photographic map of the Mississippi Delta was prepared for the Coast and Geodetic Survey and a map of Guantanamo Bay for the Hydrographic Office.

Excellent progress has also been made in the communication by wireless between aircraft and surface vessels.—*Aerial Age Weekly*, 26 December, 1921.

ANTI-AIR-CRAFT TARGET PRACTICE NEAR SAN PEDRO.—Navy officers at San Pedro are attaching much significance to the arrival of Capt. H. V. Butler, commander of air squadrons, Pacific, and his senior aide, Lieut. Comdr. P. N. L. Bellinger, in command of a squadron of six F-5-L seaplanes. The tender *Aroostook* accompanied the planes on their trip from San Diego.

Fleet gunnery officers and the air squadron commanders are working on plans for joint practice of the battleship gunners and the planes, to be held next month. The plans include the towing by the planes of kite targets above the battleships at sea. Anti-aircraft gunners will attempt to hit the targets as they are being towed overhead at a speed of 60 miles an hour, it is said. This, however, is only one of the features of the plans now being worked out. Aerial photography, a branch of work which the Navy has been developing rapidly within the past few months, will play an important part in the maneuvers.

The program, officers say, is one of the most important ever worked out by the Navy in peace times, and emphasizes the new importance attached by naval authorities to the efficacy of planes in warfare.

Navy officers say that if the experiments prove successful it is probable that all future anti-aircraft gunnery practice aboard the ships on both the Atlantic and Pacific will be carried out with the aid of planes and towing targets.—*Aerial Age Weekly*, 12 December, 1921.

ADMIRAL SIMS ON AVIATION.—*The following remarks are taken from the Waterbury Republican of November 28 and report a talk given in Waterbury before the Second Congregational Church Forum.*

That the battleship was becoming obsolete on account of the airplane, that the airplane carrier was becoming the backbone of the navy, and that scrapping of the battleships built and planned, as proposed by the disarmament conference, would not affect the defenses of this country at all, were some of the startling statements made by Rear-Admiral W. S. Sims at the Second Congregational Church Forum last night.

The Admiral referred indirectly to the controversy caused by recent utterances when he said that he proposed to speak on the question of battleships versus airplanes, armaments, etc., "So you see," he said, "they are explosive subjects, and allow all possible chances for 'indiscretions.'"

"It has been said in the past that the battleship was the backbone of the fleet," he said, "but I believe it is no more. The battleship has no defense against an airplane but small anti-aircraft guns. At the western front it was considered that one hit in 1,000 was a good average, with massed batteries for miles firing at a plane, and plenty of observation to determine the range. The best experts now agree that the results of anti-aircraft fire from a ship are negligible.

"The command of the air means the command of the surface, whether it be sea or land. The experiment of sinking the *Ostfriesland* by airplane

bombs proves that if our coast is protected by airplanes no ships can reach our shores or land troops."

The great need now is the construction of airplane carriers, he said. The latest model had an absolutely bare deck, he said, the funnels being on the sides of the ship. The deck was sufficiently wide and long to provide ample landing space. It had special elevators which carried the planes below decks. The wings of the planes could be folded up so that a large number of planes could be carried on several decks. An airplane carrier had nothing to fear from a battleship or battle-cruiser, he said, as it had a speed of 35 knots—more than any battleship or cruiser—and could always keep out of the latter's range, while the airplanes it carried could destroy the battleships.

"There are those of us who believe," he said, "that the battleship is gone and that scrapping them doesn't cut any ice whatever. We need not worry, either, about destroying the battle-cruisers now building, as they are as helpless as the battleships against airplanes."

Airplanes could be built far more rapidly and far more cheaply than ships, he said. If we spent millions on battleships and battle cruisers, and another nation spent only half as much on airplanes, he said he would have no doubt of the result.

Numerous questions were asked at the conclusion of the address. One was:

"Will the battleship become obsolete because of airplanes?"

"Yes," Admiral Sims answered.—*Aviation*, 5 December, 1921.

SPAIN TO ARGENTINA AIR LINE PROJECTED.—The Spanish Parliament is practically certain to sanction very soon the granting of a subsidy to an air company operating passenger and mail Zeppelins between Cadiz and Buenos Aires, making the trip between the two cities in ninety hours, according to an announcement by Dr. Hugo Eckner, manager of the Zeppelin works in Friedrichshafen, who has just returned to that city after a tour of South America, during which he studied conditions as applying to an air service.

The enterprise is purely Spanish, but the organization and management will be German.

Dr. Eckner declared that war experiences were such as to enable his company to guarantee the smooth operation of airships of 45,000 cubic feet in size at a rate of speed of seventy-two miles an hour while carrying between thirty and forty passengers and 300,000 letters.

The idea of the Cadiz-Buenos Aires service originated in Spain, he said, the Spaniards being anxious to establish a quick and direct connection with Spain's one-time trans-Atlantic children. Spanish negotiations with the Zeppelin management led to the organization of a commission, which has already provided 50,000,000 pesetas (about $10,000,000) of the necessary 80,000,000 pesetas (about $16,000,000), the Spanish Government guaranteeing the interest on this sum.

Speaking before the Argentine Aero Club and the German Club in Buenos Aires, Dr. Eckner emphasized the point that danger from thunderstorms and lightning did not exist for airships, since they were able to dodge tempests. He declared that excellent wind and weather conditions greatly favored the route proposed, which is 6,000 miles long.

The return journey from Buenos Aires to Cadiz will require a hundred hours, owing to the northeast winds that will be encountered.

Dr. Eckner said there were favorable terrain conditions at both ends of the route, particularly in Spain, which will facilitate hangar building. He expects that the entire capital stock of the company will be earned within two years.

It is proposed that the service will be inaugurated with three airships which will cost 36,000,000 pesetas (about $7,200,000), and hangars, gas

factories and wireless installations, costing 40,000,000 pesetas (about $8,000,000), while unforeseen expenses are calculated at 4,000,000 pesetas (about $800,000).

The expense in connection with each trip will be about 42,000 pesetas (about $8,400), and it is estimated the receipts will be about 900,000 pesetas (about $180,000) based on carrying sixty passengers at 5,000 pesetas (about $1,000) each, and 300,000 letters at 2 pesetas (about 40 cents) each.—*Aerial Age Weekly*, 12 December, 1921.

INSTRUMENT GUIDES PLANES IN FOG.—Fog is the airman's most dangerous foe, says the London *Times*. The pilot flying in cloud or fog, when he can see neither land nor sky, has no actual consciousness of direction, nor is he able to gauge the poise of his machine. True, he has a compass on board, but the lateral movement and the banking, the changes from climb to descent and vice versa, are inimical to the accurate reading of a compass. The compass card, continually disturbed by these movements, swings backward and forward, with no consideration for the magnetic north or anything else. Sooner or later the pilot is being carried by the aeroplane he knows not where. This fact has never been better illustrated than when recently a flight of machines set out from Shotwick for Dublin, a distance of only 120 miles. Heavy fog and cloud were met. One of the airmen came down off the Scilly Isles. The remainder were never found.

A device to keep the pilot constantly informed in cloud and fog of the actual behavior of his machine has just been perfected. It is called the Reid control indicator. It analyses, by means of a series of small electric lights, every tendency and movement of the aeroplane to which it is attached. It tells the pilot the air speed of his machine, its rate of turn when turning, and whether the machine is correctly banked for its rate of turn, and also direction of sideslip. It demonstrates, moreover, the movement necessary to enable the pilot to regain lost equilibrium and maintain a straight course.

The instrument weighs rather less than four pounds. It is divided into three parts, an upper row of lamps controlled by a mercury device, a lower row controlled by a gyroscope, and an air speed indicator. If the airplane is turning the lamps in the lower row light up, beginning from the center and working outward, and so indicating the direction of the turn. If the machine is sideslipping lighting is produced on the same principle in the upper row. The port or left hand lamps are red, the starboard or right are green. The center lamp in both rows is white. If the two white lights remain constant the machine is on a straight course.

The air speed indicator is set in the center of the instrument and between the rows of lamps. From it the pilot can tell whether he is climbing or descending, according to whether his speed decreases or increases.

The rotation of the gryoscope is effected by an air stream created by the flight of the aeroplane, impinging on the gyro-wheel, in which slots are cut. Under this air pressure the wheel spins at a rate of 6,000 revolutions a minute. The wheel seeks to maintain itself on a constant axis; in other words, gyroscopic action holds it in one vertical plane, and if the aeroplane turns out of that plane to right or left the wheel fights to maintain its position and automatically closes a series of electrical switches on one side or the other and the corresponding lamps in the bottom row on the indicator are lit, as explained above. The number so lit corresponds with the amount of the aeroplane's turning movement.

A mercury bubble device controls the lamps in the upper row, illuminating or extinguishing them according to the movements of the aeroplane out of or into the horizontal plane.

It is claimed that with the Reid control indicator there is no evolution that cannot be carried out by an airman in fog and cloud, and that it makes

point to point flying entirely simple in thick weather.—*Aerial Age Weekly*, 26 December, 1921.

ENGINEERING

NOTE ON THE FLOW OF AIR AND STEAM IN NOZZLES.—It is now generally recognized that steam when expanded rapidly, as in turbine nozzles, becomes supersaturated provided that the initial superheat is not so high that the steam remains superheated throughout the expansion. Whether any condensation takes place before the nozzle throat is not so definitely known, but some evidence on this point is afforded by the following note on discharge coefficients.

If the theory of supersaturation be correct, the expansion of steam through a nozzle is so rapid that condensation cannot take place down to a pressure below the critical pressure, so that down to the throat the steam expands as a perfect gas. The law of expansion is then:

$$p(V-b)^{\gamma} = \text{a constant} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where
$\gamma = 1.3$
p = absolute pressure
V = specific volume
b = co-volume, taken as the specific volume of water at 32 deg. F.

The co-volume b is only 1 per cent. of the specific volume V at pressure $p = 300$ lb. per square inch, and neglecting this the maximum theoretical discharge of steam through a nozzle may be shown to be

$$q_{max.} = 0.3155 a_t \sqrt{\frac{p_1}{V_1}} \text{ lb. per sec} \quad \ldots\ldots\ldots\ldots (2)$$

Where
$q_{max.}$ = maximum theoretical discharge, lbs. per sec.
a_t = nozzle throat area, sq. in.
p_1 = initial pressure, lbs. per sq. in.
V_1 = initial volume, cub. ft. per lb.

The effect of the small term b neglected here is only 0.274 per cent. of the discharge at a pressure $p_1 = 300$ lb. per square inch absolute. The value of V_1 to be inserted in equation (2) is in each case the specific volume of the steam at inlet, whether superheated or wet.

For saturated steam, equation (2) may be written in the convenient form:

$$Q_{max.} = M_1 a_t p_1 \text{ lbs. per hr} \quad \ldots\ldots\ldots\ldots (3)$$

Where
$Q_{max.}$ = maximum theoretical discharge, lbs. per hr.
M_1 = a constant depending upon p_1 and upon the index in the adiabatic equation, which is here taken as 1.3, the value for dry steam.

Rateau (Recherches experimentales sur l'ecoulement da la vapeur d'eau) measured the discharge of saturated steam through convergent nozzles, and found the empirical equation:

$$Q_{max.} = 366^{*}(15.26 - 0.96 \log. p_1) a_t p_1 \text{ gms. per hr} \quad \ldots\ldots\ldots\ldots (4)$$

Where
a_t = sq. cms.
p_1 = kgs. per sq. cm.

In English units this becomes:

$$Q_{max.} = 3.456(17.05 - \log. p_1)\, a_t p_1 \text{ lbs. per hr.} \quad (5)$$
$$= M_1 a_t p_1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where

a_1=sq. in.
p_1=lbs. per sq. in.
M_1=a constant depending upon p_1

Table I shows values of M_1 for $\gamma = 1.3$ (the index for dry steam) and $\gamma = 1.135$ (the index for saturated steam), and of M_2, for various values of p_1.

If the limit of the supersaturation condition is such that no condensation occurs before the throat, the ratio $\frac{M_2}{M_1(\text{for}\gamma=1.3}$ is the coefficient of discharge C_d, for saturated steam in Rateau's convergent nozzles, and this should then be of the same order in this case as for any perfect gas, such as air or highly superheated steam, through similar nozzles.

Table II shows the comparison of the coefficient

$$\frac{M_2}{M_1(\text{for}\gamma=1.3)}$$

with

1. The coefficient of discharge of air through a convergent nozzle from the experiments of T. B. Morley. (Proc. I.M.E., January, 1916.)
2. The coefficient of discharge of highly superheated steam through a convergent nozzle from the experiments of A. L. Mellanby and W. Kerr. (Trans. Inst. Engineers and Shipbuilders in Scotland, December, 1920.)

It is thus seen that the coefficient of discharge for saturated steam is, according to Rateau's tests, slightly less than that for air and superheated steam, which are about the same. On the other hand, Rateau's nozzles were not all so well shaped as those tested by Mellanby and Morley, so that the evidence, although not quite conclusive, is that there is little or no condensation in the expansion of saturated steam in a nozzle down to the critical pressure ratio. It would be an interesting investigation to determine the coefficients of discharge for steam initially wet, saturated and superheated, and for air, through the same nozzle, and thus determine whether there is any condensation before the throat with wet or saturated steam. So far as the above evidence goes, there is no such condensation, and saturated steam acts down to the throat as a perfect gas with an abiabatic index of 1.3.—Gerald Stoney, D. Sc., F. R. S., and Norman Elce, B.Sc. Tech., *Engineering*, 2 December, 1921.

TABLE I

p_1		300	250	200	150	100	50	14.689	10	5	1
M_1	γ=1.3	52.12	52.39	52.73	53.16	53.83	55.02	57.25	57.93	59.46	62.34
	γ=1.35	49.64	49.91	50.22	50.63	51.23	52.41	54.54	55.22	56.64	59.33
M_2		50.37	50.65	50.98	51.42	52.02	53.06	54.90	55.49	56.52	58.93

TABLE II

Medium	Reference	Initial pressure, Pounds per Square Inch Absolute						
		150	100	75	50	25	10	1
Saturated steam	Rateau C_d	0.967	0.966	0.965	0.964	0.962	0.958	0.945
Steam at 250 deg. F. superheat	Mellanby C_d			0.975				
Air	Morley C_d			0.97	0.97	0.97		

BERGIN COAL TREATING PROCESS.—In certain inner circles of the Continental and British coal industry, much has been heard of late of a remarkable scientific discovery, namely the Bergin process for treating coal. Its inventor is Dr. Friedrich Bergius, a German chemist. According to the London *Times*, the new method consists in subjecting coal to enormous pressures ranging between 100 and 200 atmospheres and in adding hydrogen. In the final result motor fuels, lubricating oils, lamp oil, paraffin wax and other valuable products are obtained. The process has been successfully tried on a large scale at a plant erected at Rheinau. As crude petroleum can be treated by the Bergin process as well as coal, the Royal Dutch and Shell Group have become interested in a company formed to develop and exploit it outside of Germany.

Another interesting process for treating coal is the one devised by a Dr. L. Steinschneider, who is a citizen of Czecho-Slovakia. At his plant at Koenigsfield, he first slowly distils coal until it has yielded a large percentage of liquid. This liquid is then treated in such a way as to obtain a high percentage of products, including motor fuel. Dr. Steinschneider makes use of a retort still, which does away with high temperatures and smelly products.—*Nautical Gazette*, 17 December, 1921.

BENZINE FROM COAL GAS.—A benzine-stripping plant has given very satisfactory results in Wittenberg on the Elbe. New municipal gas works, only of a capacity of 6,000,000 cub. m. of gas per year, were opened in summer, 1920; they had been built up by the Berlin Anhaltische-Maschinenbau A.G., at a cost of 85,000 marks, and the addition of the benzine plant raised the cost to 110,000 marks. By April, 1921, when the works had been in operation for seven and half months, 18, 595 kg. of benzine had been gained according to the manager's report in the *Journal für Gas und Wasser*, page 643, which worked out at 14 grammes of benzine per cubic metre of gas treated. There were no complaints about the gas, and financially the stripping was a decided success, owing largely to the demand for motor fuel.—*Engineering*, 16 December, 1921.

MOTOR ARRANGEMENTS FOR ELECTRIC SHIP DRIVES.—The electrically-driven ship appears to be establishing a place for itself, particularly in America, while in the case of the San Benito an important example has recently been completed at Belfast by Messrs. Workman, Clark. In these circumstances the electrical features of such ships are probably worth more attention from electrical engineers in general than they have yet received. A ship may be propelled by means of a squirrel cage motor, an induction motor with a wound secondary, or a synchronous motor. Something may be said for each of these various methods, and the finally best arrangement for any particular type of service is hardly yet established. To confine consideration of these three types of motor only is, of course, to neglect direct-current, which can be, and has been, used. For turbine drives, however, which have so far been adopted for the more important installations, alternating current offers advantages, and for the moment attention may be confined to it. Of the three United States electric battleships which are in service the *New Mexico* has motors with a double squirrel-cage rotor winding, the *Tennessee* has motors with a form-wound rotor, with external starting and manœuvering resistances, and the *Maryland* has motors with combined squirrel-cage and form-wound rotors. The fitting of various arrangements to these important ships is obviously a wise policy, and experience gained with them should assist in determining the best all-round system for battleship work.

An interesting consideration of the qualifications of the various forms of motor for ship propulsion generally is contained in a paper read by

Mr. W. E. Thau before the Society of Naval Architects and Marine Engineers at the New York meeting the week before last. In addition to the alternating-current arrangements we have considered, Mr. Thau also put forward an arrangement with induction motors having wound secondaries worked in conjunction with a system of power-factor correction. It is not clear if this system has ever been employed, but assuming one is prepared to accept the extra moving machinery involved in the phase advancer, which is not a complicated feature in itself, then the system has the advantage of the unity power-factor of the synchronous motor coupled with the simplicity of and the torque characteristics of the wound secondary induction motor. At the same time synchronous operation is not demanded. The straightforward squirrel cage and wound secondary arrangements have the advantage of simplicity and ease of handling. The torque characteristics of the wound rotor are, however, the better of the two, and the chief claims of the simple squirrel cage is that it is robust and inexpensive. By incorporating a double secondary winding as in the case of the *New Mexico* the torque characteristics are improved.

Direct current in its convenience of control has considerable advantage for ship driving, but difficulties are met at the generating end with a turbine drive. When, however, the generator is driven by a Diesel engine the advantages of direct current are leading to its adoption. The Diesel electric ship is at present the subject of a good deal of attention and a number are being built. It is interesting to note that Mr. Thau claims the Diesel electric drive to be the cheapest of all. As compared with the direct Diesel drive the engines do not require to be fitted for reversing. Mr. Thau's main argument in this connection appears to turn, however, on the fact that the relatively small Diesel engines and generators fitted to electric ships can be manufactured on a production basis and more or less bought out of stock, while the direct-drive Diesel will have to be built for its job. There is possibly something in this, but the development of the direct-drive Diesel will also ultimately lead to standard and cheaper types. Some real data on the subject would be of interest. Mr. Thau would appear to be in favour of the Diesel-electric ship generally, and he claims it requires less *personelle* to drive it than a direct-connected Diesel equipment.—*Engineering*, 2 December, 1921.

REMARKABLE RESULTS WITH TURBINE BLADES OF STAINLESS STEEL.*—Stainless steel, which is an alloy containing from 12 per cent to 14 per cent of chromium, was discovered at the Brown-Firth Research Laboratories, Sheffield, by Harry Brearley, in 1912, and in a report on its properties, written in October of that year, Mr. Brearley suggested its use for the blading of steam turbines.

Several years elapsed before this suggestion was given a practical test. This delay is not surprising, in view of the unsatisfactory results obtained with other materials for which great things have been predicted. It was in 1916 that F. Samuelson, of the British Thompson Company, Rugby, determined to make the trial and, with the consent of one of his clients, used five different kinds of material for the blading of one wheel of a steam turbine. The materials selected were phosphor-bronze, nickel-bronze, brass, mild steel and stainless steel. Of the four stainless-steel blades inserted, two were hardened and the other two hardened and tempered. The turbine with this experimental wheel was set to work in the autumn of 1916, and opened up for the first time in April, 1918, when all the blading was found to be in good condition, although the stainless-steel blades were the only ones entirely free from erosion or corrosion, the greatest sufferers being the brass blades.

* Abstract of article entitled "Some Engineering Uses of Stainless Steel," published in the Oct. 28 issue of *Engineering*, London, England.

Blades Unaffected by Service

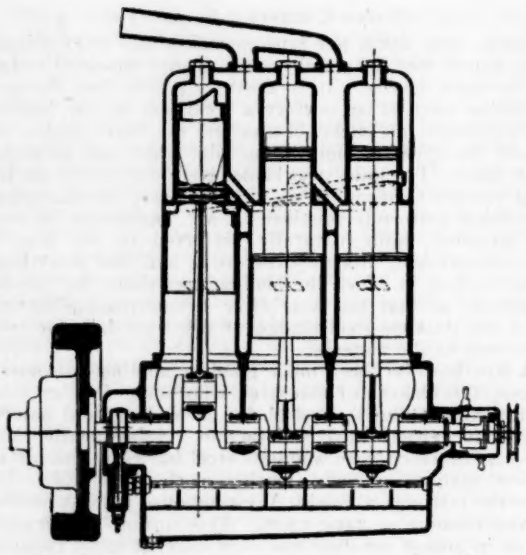
The machine was again put into operation and re-examined last July, when it was found that the stainless-steel blades appeared to be absolutely unaffected by their service. It is worthy of note that the hardened and tempered blades were in as perfect a condition as the hardened blades. The phosphor-bronze, the nickel-bronze and the brass blades, on the other hand, showed the usual erosion at the inlet edges and to about the same extent in all cases. The mild-steel blades were not merely eroded, the inlet edge having lost one-sixteenth of an inch, but were also corroded generally, the surface being uniformly roughened. Mr. Samuelson, in experimenting with new materials, quite naturally preferred in the first instance to attempt no exceptionally drastic experiment and had accordingly selected for his trial a wheel in which the blading was short, the stresses low and vibration absent, so that his test, while demonstrating the resistance to corrosion of the stainless-steel blades, afforded no data for estimating the mechanical value of the material.

This lack has, however, been made good by another customer of Messrs. Firth & Sons, the makers of the steel, who some four or five years ago fitted into a turbine stainless-steel blades 28 in. long, and now reports that these blades have given entire satisfaction. Subsequently, Messrs. Firth themselves experimented with stainless-steel blades in one of the turbines at the power station of their Tinsley works, Sheffield. The machine selected for the test was a British Westinghouse impulse turbine, rated at 2,000 kw. and running at 3,000 r.p.m. This turbine was installed in 1916 and has been in almost constant use ever since, at loads ranging from full load down to one-quarter load. The steam supply is furnished at a pressure of 200 lb. per sq. in. (gage) and at a temperature that has averaged about 600 deg. F. The turbine in question has one velocity stage with two rows of moving blades with a mean diameter of 3 ft. 7½ in. followed by seven simple impulse stages, 4 ft. 1½ in. in mean diameter. The blading originally supplied to this turbine was a nickel steel containing 0.19 per cent of carbon and 4.71 per cent nickel.

The Messrs. Firth Begin Experiments

It was not till June, 1920, that Messrs. Firth were themselves able to take up Mr. Brearley's suggestion made in 1912, and began experiments of their own on the suitability of stainless steel for steam-turbine blading. On that date the turbine already described was opened up and experimental blades were fitted to two of the wheels, constituting the first, or velocity, stage of the turbine and the last stage, which is fed with wet steam. In the latter stage the blades are subject to the heaviest centrifugal and bending stresses. These blades are 7 in. long and ¾ in wide, while the velocity-wheel blading contains six blades of stainless steel, three being highly polished and the remaining three in the unpolished condition. On the opposite side of the wheel three more stainless-steel blades were inserted alongside of three new 5 per cent nickel-steel blades obtained from the builders of the turbine. In the velocity blading, 24 blades were replaced by 21 blades of stainless-steel (three of which were polished) and by three new blades of 5 per cent nickel steel. These blades were ⅞ in. long by ¼ in. wide. The stainless steel used contained 13.4 per cent of chromium and 0.30 per cent of carbon.

The turbine was recently opened up after having operated 3,471 hours with the experimental blading. The stainless-steel blades appeared to be totally unaffected by the work done, as no corrosion and no erosion could be detected either by the eye or by touch. The inlet edges, where erosion is always most marked, were perfectly smooth, while those of the new nickel-steel blades inserted at the same time were materially roughened.



and these blades had suffered corrosion. In the case of the nickel-steel blades originally fitted in 1916, the erosion was very noticeable, and the blades were deeply pitted and corroded. When the turbine was opened up, there were found to be some markings on the stainless-steel, but these were easily removed with a damp rag, leaving a perfectly clear and smooth surface. These experiments seem to show that stainless-steel is superior both to phosphor-bronze and to nickel-steel as a material for turbine blades.

Another interesting engineering application of stainless steel is to the rams of hydraulic pumps. A test pump supplying water at a pressure of 1,000 lb. per sq. in. has been at work since 1915. One of the rams is of stainless-steel, and the other of phophor-bronze. The stainless-steel ram has maintained its original polish much better and has worn down only 1/64 in. as against 7/64 for the phosphor-bronze.

All the experiments so far made with this material seem to indicate that it has great promise as an engineering material and will find many new uses. In this connection it should be noted that the methods of forging, heat treatment, etc., must be adapted to the special properties of stainless steel. As an example of the ways in which this alloy differs from ordinary carbon steel, it may be noted that stainless-steel retains most of its strength up to a dull-red heat.—*Power*, 20 December, 1921.

A VALVELESS GEARLESS ENGINE.—We are informed by a correspondent that an internal combustion engine embodying some novel features of design has just been constructed for the inventor at the G. D. S. Works, Manchester. The bench tests have been remarkably promising, and the engine will shortly be installed in the chassis, and the car will be used for demonstration purposes. The engine is the invention of Mr. W. F. Wege, an Australian engineer.

It is a "two-stroke," built with three (or multiples of three) cylinders. Other than the ports, there are no valves, there is not a single gear wheel in the engine, and all cams, shafts, tappets and springs, and even the timing gear, are eliminated. The moving parts consist only of the crank shaft, pistons and connecting-rods. The experimental engine is rated at 10 horse-power, and on bench tests has developed 20 horse-power. The cylinder blocks, as shown in the accompanying cut, are designed with two diameters having a common piston, which is connected to the crank shaft in the usual way by a connecting-rod. The lower or pump chambers of the cylinders are connected by a common manifold inlet, which in turn is coupled to the carburetter.

The cycle of operation is as follows:—On the down stroke of the piston a vacuum is formed in the pump chamber, and at the end of the stroke the exhaust port in the explosion chamber is uncovered. So also is the inlet port of the lower chamber, into which the gas then enters. On the return stroke the charge is compressed, and when the transfer port is opened, is passed into the explosion chamber of the adjoining cylinder. In like manner the second cylinder feeds the third, and the third transfers its charge to the first.

The engine has been designed to meet conditions existing in Australia, which call for a car light but strong, with a good clearance and a wide track, but above all, with a power unit simple of construction. Motoring in Australia soon carries one beyond the reach of repair shops, and what may have to be done by the wayside to car or engine must be as simple as possible. When the Wege engine has passed through the strictest of tests here, on the road and in the laboratory, the company intends to build in Australia for Australia.—*The Engineer*, 16 December, 1921.

NAVIGATION AND RADIO

COAST SURVEY'S ACTIVITIES IN MEASURING EFFECT OF CURRENTS

The annual report of the Director of the Coast and Geodetic Society has just been issued. It contains much that is of interest to the public and dwells especially on the need of more extended current obsrvations, to the lack of which is attributed the loss of many vessels and lives. The situation is summed up in the following quotation from the report:

"During the years from 1900 to 1921 there were stranded or wrecked on the Pacific Coast of the United States more than 100 vessels involving a loss of hundreds of lives and millions of dollars in property, and this is in spite of the fact that our navigators on the Pacific Coast comprise an unusually able, keen and alert group of men. To a large extent this loss was due to the lack of knowledge of the effects of the currents on the Pacific Coast. Had there been adequate knowledge of these currents, a large part of this enormous loss certainly would have been prevented.

"In the safeguarding of life and property on the Pacific Coast a knowledge of the currents is of the utmost importance, for in the more than thousand miles of coast line that stretches from the Mexican border to the Strait of Juan de Fuca, harbors are many miles apart, sailing courses long, and periods of thick weather are of comparatively frequent occurrence.

"Appropriations for the observation of currents have to the present time been so small as not to permit the maintenance of a vessel for making a detailed systematic study of the treacherous and little-known currents of the Pacific Coast. By taking advantage of the five light vessels stationed along the coast, the Survey has at little cost secured observations which have brought out the important fact that, contrary to the belief of the mariner, a wind creates a current not in its own direction, but in a direction about 20° to the right of the wind. The importance of this discovery lies in the fact that a wind blowing parallel with the coast may

produce a current which tends to set a vessel on the shore, a fact which until now has been unsuspected by the navigator.

"Given the modest appropriation necessary to carry into effect the plans outlined for a systematic survey of the currents along the Pacific Coast, a long step will have been taken toward the safeguarding of life and property in the navigation along that coast.

"The appalling loss of life and property in the wreck of the *Alaska* on August 7th on the Coast of California is a compelling argument for the charting of the currents on the Pacific Coast. Only one explanation of the wreck has thus far been offered. The second officer of the *Alaska* declares that an uncharted northeast current dragged the fog-bound ship several miles inshore into the reef."—*Nautical Gazette*, 24 December, 1921.

BENSON RECORDING COMPASS.—When a vessel's master lays out a course, he can not be positive that it is being followed by the wheelman or quartermaster, unless he is constantly checking it up. The vessel may be working off the course with a resultant extra milage, increase of running time and enlarged fuel consumption. The fact that a captain finds the ship on her course upon his return to the bridge after an hour's absence on other duties affords no guarantee of her having sailed continuously on the true course during that hour.

The Benson recording compass, (of which about forty are now in use) gives a vessel master a continuous record of the ship's movements. It is usually installed in the captain's cabin but may be installed in any other place if he so prefers. By a glance he can tell how the vessel is working, or what has happened during any interval of time which may have elapsed. The slightest change in direction and the actual time at which it occurred is automatically and accurately registered by this instrument.

This accurate record of the heading of the ship and of the time required for each manœuver is secured by means of a special compass to which a small pivoted arm tipped with a pointed stylus set at right angles to the arm and in contact with the record chart is attached. The chart on which the record is made has a series of concentric circles indicating the periods of time. Intersecting these circles is a series of equally spaced lines each corresponding to the arc of circles described by the pivoted recording arm. The stylus corresponds to the "lubber mark," each line terminating at a compass point on the margin of the record chart. It makes a white dot on the chart every three seconds.

When a vessel is on a straight course this dot becomes a line, but should she swing rapidly this line is composed of a series of dots thus giving prominence on the record chart to any sudden or unusual movement. No ink or dye is used on the chart, as it has a smoked surface. When the chart is removed it is dipped in a fixing solution, making a permanent record which will not be defaced in handling. The perfection of the Benson recording compass was first proven by a thorough test on a submarine during which every movement of the underseas boat was recorded with the greatest accuracy.—*Nautical Gazette*, 31 December, 1921.

POLAND AND U. S. TO HAVE DIRECT RADIO COMMUNICATION SOON.—A contract for the erection of a powerful wireless station near Warsaw, Poland, has been awarded to the Radio Corporation of America. The station, which will cost between two and three million dollars, will form a link of communication between Poland and the United States which will facilitate commerce between the two countries.

At the present time cable communication between Poland and the United States is far from being satisfactory. Messages passing between the two countries must of necessity pass over lines owned and operated by com-

panies with neither Polish nor American interests. In many cases it has been necessary for messages originating in Warsaw and destined for New York to pass over the lines of a number of different telegraph and cable companies, and with every one of the repetitions and reforwardings there is a possibility of errors and delays.

With the completion of the new radio station delays and errors will be eliminated and business men in Poland will be able to thrash out their transactions with the commercial heads of America with almost the same speed that obtains in a personal interview. The new radio station recently opened on Long Island will operate directly with the Warsaw station when it is completed. The transmitting unit which will be placed in operation in Poland will be similar to, although smaller than, that being installed on Long Island. A number of improvements in the science of radio telegraphy will be embodied in the Polish equipment, and with very few changes the station could be used for radio telephony. In conjunction with the antennae a system will be employed which will eliminate the formation of sleet and ice on the wires. This will be accomplished by passing a heavy electric current through the wires which will become heated in consequence. In a climate like that of Poland this is an important feature, for ice would form on the wires during the winter, and the added weight being too great for the tensile strength of the wire, would cause the antennae to collapse.

Long-range radio is quite different from the kind employed on commercial vessels for the systems used are entirely different. The power of the former is approximately 100 times as great as that of the latter. It has been found inadvisable to attempt to have the receiving apparatus located in the same building as the transmitter, for in long distance transmission it is essential for the stations to be capable of duplex operation. They must be able to send and receive simultaneously, which is not common with the radio equipment found on vessels.

Showing the need of direct radio communication between America and Poland, competent investigators have stated that one-fifth of all persons of Polish extraction are residents in the United States. In proportion to the native population, this is a higher percentage than the case of the nationals of any other country.—*Nautical Gazette*, 24 December, 1921.

RADIO DIRECTION FINDERS AID RESCUE WORK AT SEA.—Commissioner of Lighthouses George R. Putman is calling attention to two striking illustrations of the importance of radio bearings in rescue work at sea. The Norwegian steamer *Onataneda* was in distress off Newfoundland and gave her position by dead reckoning 90 miles in error. The only ship able to discover her correct position was the steamship Fanad Head, equipped with a radio direction finder, which was thereby enabled to save the lives of those on board of *Onataneda*.

The steamer *Wahkeena* was within 14 miles of the steamer *Alaska*, recently lost off Cape Mendocino, Cal., when she picked up the latter's radio distress signals. It was 10 hours, however, before the *Wahkeena* reached the scene of the wreck, as she had no means of determining the direction of the signals. Many lives might have been saved had there been a radio fog signal on Blunts Reef Light Vessel and radio compasses on the *Alaska* and *Wahkeena*.—*Nautical Gazette*, 10 December, 1921.

ORDNANCE

A 4000-POUND AIRCRAFT BOMB.—The Ordnance Department of the Army is making plans for an ariel bomb to weigh 4000 pounds, which is very much larger than any bomb of the kind ever before conceived in the United States. It is to contain over 50 per cent or 2400 pounds of

TNT, and will be one of the most deadly of all bombs known in modern warfare. Up to the present the largest bombs designed and constructed weigh but 2000 pounds. These already have been adopted as standard, together with bombs weighing 1100 pounds, 600 pounds, 300 pounds, and 100 pounds, respectively, all of which contain about 50 per cent of TNT. The new bomb weighing 4000 pounds are to be used in connection with the largest bombing airplanes.—*Scientific American*, December, 1921.

MISCELLANEOUS

RELEASE OF NORWEGIAN SEALERS.—The three Norwegian sealers which were seized by the Bolshevists in June have now been released and permitted to return to Bergen, while the matter of the very heavy fines imposed for alleged illegal sealing are now the subject of discussion by the Soviet authorities at Moscow. The help given by the Norwegians to the famine-stricken areas is the reason for the reconsideration of the matter.—*The Marine Engineer and Naval Architect*, December, 1921.

MINES IN THE MEDITERRANEAN.—Mines are still proving themselves very troublesome in the Mediterranean, one of the most important casualties of the month being the Italian steamer *Chile*, a 3,218 ton ship launched in 1885 as the Greenshields Cowie *Knight of St. John*. She struck a mine off the south coast of Greece while carrying wheat to Russia and sank in a very short time. All the crew were saved.—*The Marine Engineer and Naval Architect*, December, 1921.

ITALIAN VESSEL OVERWHELMED BY STORM.—The Italian destroyer *Centauro* sank today in a violent storm off the Island of Trianesia.

The crew were all rescued, and active efforts are being made to salve the destroyer.—*Naval and Military Record*, December, 1921.

MOTOR LAUNCHES IN MOROCCO.—In their campaign against the Riffs in North Africa, the Spaniards are making great use of the six 80 ft. motor launches which they purchased from the Royal Navy after the Armistice. They are able to get close inshore and do considerable damage with their machine guns, while their rapid manœuvering has up to now puzzled the Moorish gunners.—*The Marine Engineer and Naval Architect*, December, 1921.

CURRENT NAVAL AND PROFESSIONAL PAPERS

Speed Reduction for Ship Propulsion—*The Marine Engineer and Naval Architect*, December, 1921.

Strategy and Tactics of Small Wars—*Marine Corps Gazette*, December, 1921.

Recent Developments in the Krupp Works at Essen—*The Engineer*, 9 December, 1921.

Viscosity of Steam Turbine Oils—*Power*, 27 December, 1921.

Transmission Characteristics of the Submarine Cable—*Journal of the Franklin Institute*, December, 1921.

The Exponential Method in the Analysis of the Balance of Reciprocating Masses—*Engineering*, 9 December, 1921.

The Radio Central—*Scientific American*, January, 1922.

Bombing and Bombing Sights—*Scientific American*, January, 1922.

Researches on Modern Brisant Nitro-Explosives—*Reprint and Circular Series of National Research Council*, Number 15.

NOTES ON INTERNATIONAL AFFAIRS

FROM DECEMBER 10 TO JANUARY 5

PREPARED BY

ALLAN WESTCOTT, Professor, U. S. Naval Academy

WASHINGTON CONFERENCE

AMERICAN RESERVATIONS TO PACIFIC ISLANDS TREATY.—The four-power treatly regarding the Pacific Islands, the contents of which were published in the December issue of the PROCEEDINGS, was signed in Washington on December 13. The American delegates signed with reservations expressed in the following explanatory note, which was accepted by the other signatories:

In signing the treaty this day between the United States of America, The British Empire, France and Japan, it is declared to be the understanding and intent of the signatory powers:

1. That the treaty shall apply to the mandated islands in the Pacific Ocean, provided, however, that the making of the treaty shall not be deemed to be an assent on the part of the United States of America to the mandates and shall not preclude agreements between the United States of America and the mandatory powers, respectively, in relation to the mandated islands.

2. That the controversies to which the second paragraph of Article 1 refers shall not be taken to embrace questions which according to principles of international law lie exclusively within the domestic jurisdiction of the respective powers.

Washington, D. C., December 13, 1921.

PACIFIC TREATY INCLUDES JAPANESE HOMELAND.—In view of the interpretation made by President Harding and others that the Pacific Islands Treaty did not apply to the islands of the Japanese archipelago proper, the American delegates stated that it was the understanding of those who negotiated the treaty that the Japanese homeland was so included. The Japanese delegates on December 27 announced to newspaper correspondents that Japan was indifferent as to the inclusion of the main land, and regarded the matter as of minor importance. It appeared likely that an agreement excluding the Japanese homeland might be embodied in a protocol to the original treaty.

NAVAL AGREEMENTS.—It was anticipated that upon the conclusion of conference sessions in January, the naval agreements reached would be em-

bodied in a treaty to be signed by the five participating powers. The agreements reached up to January 5 were summarized thus:

First—An agreement by the five naval powers by which America, Great Britain and Japan will scrap sixty-eight capital ships of an aggregate displacement of 1,861,643 tons.

Second—that after the naval holiday and the completion of replacement, the capital ship tonnage of the five principal powers shall be in the ratio of 5—5—3—1.67—1.67, that is, that the replacement capital ship tonnage of Britain and the United States shall be 525, 000 tons each, that of Japan 315,000 tons, that of France 175,000 tons, and that of Italy 175,000 tons.

Third—that the size of future capital ships shall be limited to 35,000 tons per ship.

Fourth—That in the event that all five of the nations build individual capital ships up to the displacement limit of 35,000 tons a ship, England, after replacement, would have fifteen capital ships, America fifteen, Japan nine, France five and Italy five. On this basis the five fleets would have a maximum of only forty-nine capital ships, each of not more than 35,000 tons, or an aggregate tonnage for the forty-nine vessels of 1,715,000 tons, less for all five than what it is proposed that three nations shall scrap.

Fifth—That no capital ship shall mount any gun of more than 16-inch calibre.

Sixth—That there shall be a naval holiday in the matter of capital ship construction running for ten years during which neither the United States nor Japan will build capital ships, exception being made only in favor of two modified Hoods to be built in that period by the British, and several of the French replacement capital ships to be started before the expiration of the holiday.

Seventh—That a limitation be put on the construction of aircraft carriers on the basis of 135,000 tons for the United States, 135,000 tons for Great Britain, 81,000 tons for Japan, 60,000 tons for France and 60,000 tons for Italy, no carrier to be of greater individual displacement than 27,000 tons, the few existing airplane carriers to be considered as "experimental" and scrapped as soon as replaced.

Eighth—No limitation on the extent of submarines or auxiliary surface combatant craft, such as light cruisers, destroyers and flotilla leaders, to be built by any nation, other than aircraft carriers, failure to agree in this respect being due to the decision of the French Government that it needs 90,000 tons of submarines and 330,000 tons of auxiliary surface craft.

Ninth—An agreement on the size of cruisers and other auxiliary craft. The conference has agreed that no war vessel other than a capital ship or airplane carrier shall be of greater displacement than 10,000 tons, but this has not been approved by the French delegation, which has asked for instructions on the subject from its Government.

Tenth—No vessel other than a capital ship is to carry any gun with a calibre in excess of eight inches.

NO FORTIFICATION OF PACIFIC BASES.—On December 15 the U. S. State Department made the following announcement of agreement reached with respect to naval bases in the Pacific:

It is agreed that with respect to fortifications and naval bases in the Pacific region, including Hongkong, the *status quo* shall be maintained, that is, that there shall be no increase in these fortifications and naval bases except that this restriction shall not apply to the Hawaiian Islands, Australia, New Zealand, and the islands composing Japan proper, or, of course, to the coasts of the United States and Canada, as to which the respective powers retain their entire freedom.

Under the agreement for maintenance of the *status quo* to fortifications and naval bases in the Pacific the United States will refrain from further development of fortifications and advance bases at Guam and the Philippines, while Japan will refrain from further development of fortifications and naval bases in the Pescadores, Bonin Islands and O-Shima, and from building forts in other islands not a part of Japan proper. Similarly England will maintain the *status quo* with respect to fortifications and naval bases at Hongkong and other British islands.

NAVAL DEMANDS OF FRANCE.—At the opening of discussions regarding the French navy, the French delegates demanded a ratio of 3.5, which would enable France to build 10 capital ships. Secretary of State Hughes thereupon sent two notes to Premier Briand urging that this demand be modified. Premier Briand finally consented to the ratio finally adopted, that of 1.67, but insisted upon a much higher ratio for auxiliary ships, especially submarines.

England's appeal for abolition of submarines was not supported by the other four powers. Upon the demand made by France for a submarine tonnage of about 90,000, approximately equal to that of Great Britain and the United States, Secretary Hughes offered the following modification of the original proposals:

United States: Original plan, 90,000; new plan, 60,000.
Great Britain: Original plan, 90,000; new plan, 60,000.
Japan: Original plan, 55,000; new plan, 31,500.
France: Original plan not decided; new plan, 31,500.
Italy: Original plan undecided; new plan, 21,150.

This proposal was accepted by Great Britain. The French government, however, refused to recede from its original position, and no further effort was made to restrict auxiliary tonnage of any kind.

PROPOSED RESTRICTIONS ON SUBMARINE WARFARE.—In view of the failure to restrict submarine construction, Mr. Elihu Root on December 28, proposed a set of resolutions restricting the use of submarines in war. Art. I of these resolutions was merely a statement of existent international law, and as such was at once accepted in principle by all the powers. The second and third articles prohibited the use of submarines against merchant vessels; and they were therefore less readily acceptable. After consulting their home governments, the Japanese and French delegates expressed their willingness to accept the second and third articles "in principle," subject to further discussion of methods involved in the use of submarines in commerce warfare, including the definition of a merchant vessel and the use of submarines in blockade. The resolutions were finally accepted, as follows:

I. The signatory powers, desiring to make more effective rules adopted by civilized nations for the protection of the lives of neutrals and noncombatants at sea in time of war, declare that among those rules the following are to be deemed an established part of international law.

(a) A merchant vessel must be ordered to submit to visit and search to determine its character before it can be seized.

A merchant vessel must not be attacked unless it refuses to stop for visit and search after warning, or to proceed as directed after seizure.

A merchant vessel must not be destroyed unless the crew and passengers have been first placed in safety.

(b) Belligerent submarines are not under any circumstances exempt from the universal rules above stated, and if a submarine cannot capture a merchant vessel in conformity with these rules, the existing law of nations requires it to desist from attack and from seizure, and to permit the merchant vessel to proceed unmolested.

II. The signatory powers invite all other civilzed powers to express their assent to the foregoing statement of established law, so that there may be a clear public understanding throughout the world of the standards of conduct by which the public opinion of the world is to pass judgment upon future belligerents.

III. The signatory powers recognize the practical impossibility of using submarines as commerce destroyers without violating, as they were violated in the recent war of 1914-1918, the requirements universally accepted by civilized nations for the protection of the lives of neutrals and noncombatants, and to the end that the prohibition of the use of submarines as commerce destroyers shall be universally accepted as a part of the law of nations they now accept that prohibition as henceforth binding as between themselves, and they invite all other nations to adhere thereto.

CONTROL OF AERIAL WARFARE.—The committee of experts, named to prepare a report on ways and means of controlling war airplanes, has completed its work, and the results of its labors are not encouraging, so far as action by the Washington conference goes. The task assigned the committee was in three parts. These, with the reply of the experts, stated briefly, are:

1. Usage—It is not feasible for a conference of five powers to lay down rules for the war use of airplanes, since all nations may have airplanes. Therefore, this matter can best be considered at a meeting of wider scope.

2. Number—In view of the essential similarity between peacetime airplanes and wartime airplanes, and the ease with which one may be converted into the other, and in view of the impossibility of limiting the number of peacetime airplanes that any nation may have, the committee is unable to make any recommendations as to the number of airplanes which a nation may have for military use.

3. Form—It is evident that a freight-carrying airplane may be easily converted into a bomb-carrying airplane; it is probable that any limit placed upon the development of fighting airplanes would be ineffective because the sporting and racing airplane of peacetime is developed along the lines of war planes. Therefore, the committee has no concrete proposals as to the control of the form of airplanes.

This is a summary of the experts' conclusions, which are stated at great length.

The report does not mean finally that the Washington conference can do nothing about regulating airplanes, but it does put into concrete form the difficulties of action here. With regard to airplanes, as with regard to poison gas and laws of war, the trouble about taking action here is that five nations can hardly be supposed to tie their hands with respect to use of some weapon of war if potential enemies are not subject to the same limitations.

An expert pointed out tonight that the League of Nations was working on the problem of controlling the inhumane use of airplanes in war and it seemed to him that the matter could be better considered at the next assembly of the League than at the Washington conference.—*New York Times*, 30 December, 1921.

FRENCH VIEW OF NAVAL LIMITATIONS.—The following extracts from an article entitled "London and Washington in Accord" in the French magazine, *La Vie Maritime*, suggest clearly the French view of Washington agreements. "The immediate, bold, peremptory presentation of such a programme [the Hughes proposals] at the opening session produced at first an effect of stupefaction. We suppose, however, that England previously had some idea of what was to occur. The diplomatic activity between London and Washington in the last few months has already been noted. The English delegate, Mr. Balfour, had the air of a man informed and convinced; he encouraged Mr. Hughes and found no difficulty in agreeing in principle to the American proposals. . . . Certain American journals have found occasion to applaud loudly the triumph of Washingtonian diplomacy, on the ground that it has induced Great Britain to abandon her maritime supremacy, and has achieved the freedom of the seas. But this is going too fast. In reality, the British fleet retains first rank, with 22 dreadnoughts against 18 American; and if she secures the eventual support of Japan, which is not improbable, she will have 14 units more than the United States. This is no longer the 'two-power standard,' but the time has not come for the descendants of Nelson to give up their traditional slogan, 'Rule Britania.'

"France has not cut an important figure in all this. In fact, this is the first international conference in which we have taken part where we have been treated almost as a negligible quantity. Only Great Britain, the United States, and Japan are mentioned. The rest, so to speak, do not count. France and Italy, in this plan, are charitably allowed to retain the little naval strength they already possess. It appears too completely forgotten, indeed, that the French colonial empire is immense; that we are a far eastern power of the first rank, with valuable frontages on all oceans; that we have a frontier and interests in common with China, and possessions of great value in the Pacific. . . . If M. Briand returns empty-handed, or even with unsatisfactory terms, under whatever pretext or whatever their form, how shall he be received? It is a matter which concerns our future, even our existence."

FAR EASTERN QUESTIONS

CHINESE PROBLEMS UNSETTLED.—At the renewal of sessions of the Washington conference in January, many of the questions relating to China awaited final settlement. It was predicted that Japan and China would ultimately reach an agreement for the surrender of Shantung, that Great Britain would relinquish Wei-hai-wai, and that a nine-power treaty would be drawn up embodying the various concessions to

China relative to control of customs, withdrawal of troops, relinquishment of foreign control of courts, postal service, etc.

Direct negotiations between Japan and China over Shantung ended on December 20 in a deadlock over the method by which China should take over and pay for the Shantung railway. The Chinese delegates on January 4 appealed to Mr. Balfour and Mr. Hughes to act as intermediaries in this matter.

The sub-committee on Chinese tariff reached a compromise proposal to the effect that China should be permitted to levy immediately an effective ad valorem tariff of 5%, as opposed to the present nominal 5% tariff which yields only 3½% owing to pre-war valuations on goods. This effective 5% tariff would be increased shortly to 7½%, and thereafter, upon abolition of the Likin, or provincial tax, to 12½%. The proposed 5% tariff would increase China's revenue by 10 million dollars.

GOVERNMENT OVERTHROW IN PEKING.—On December 13, Gen. Chang-Tso-lin, super-Tuchun and Inspector General of the three provinces of Manchuria, assumed the powers of dictator at Peking, forcing the resignation of the premier and cabinet. While the new powers in control were reactionary in character, it was hoped that they would succeed in establishing a stronger central government, with support from all factions in China. The new premier, Liang-Shih-yi, is a man of wealth, long prominent in Chinese politics and finance. His cabinet includes two holdovers from the former ministry, Dr. Yen remaining Minister of Foreign Affairs.

JAPAN IN SIBERIA.—On January 2 delegates from the Chita government, or Far Eastern Republic, who had attempted unsuccessfully to secure a hearing in Washington, gave to the press what purported to be documents proving negotiations between France and Japan by which France agreed to support Japanese policy in Siberia in return for aid in restoring the former Russian régime. These documents were at once repudiated by both France and Japan.

The divergent reports of the Japanese and the Chita delegates regarding the situation in Siberia were summarized on December 29 as follows:

1. The Chita delegation says that the Japanese are demanding recognition by the Far Eastern Republic of treaties concluded with General Semenoff, and with the present Merkuloff Government in Vladivostok, giving them executive rights in fisheries, hunting and the lumber business, as well as in certain mining industries.

The Japanese say they never made such treaties and would not ask the Far Eastern Republic to recognize them even if they had.

2. The Chita delegates say that the Japanese have demanded the right to own land, "which privilege no Russian citizen possesses in the Far Eastern Republic, and which even under the Czar was denied to all, including Russian subjects."

The Japanese, however, say that they do not demand the right of land ownership. At present, according to their version, no foreigner is even permitted to lease land in Siberia. They would be satisfied with an agreement permitting leases on moderately long terms—not necessarily ninety-nine years or anything like that, but long enough to give an invest-

ing company a chance to get a fair return on their capital. And this privilege, they say, they are asking for all foreigners on equal terms, and not only for themselves.

3. The Chita delegation asserts that the Japanese request of the right to maintain "representatives" in the cities of the Far Eastern Republic does not refer to consular representatives, but that the demand has been made at Dairen that Japan be allowed to retain garrisons in the principal cities.

The Japanese profess the intention of withdrawing all their forces, except those in the province of Sakahlin, if they can get adequate guarantees for the safety of the lives and property of Japanese subjects.

The Japanese contention all along has been that they needed adequate guarantees for the safety of the lives and property of their subjects in Siberia, especially those in the Vladivostok district, who number some 8,000, and most of whom had a good deal of property before the Russian revolution. Consequently, they argue, order must be restored and a viable Government formed before their troops can be withdrawn. The Far Eastern representatives hold that the maintenance of order and the guaranty of life and property has been made difficult chiefly by insurrections promoted by the Japanese.—*New York Times*, 30 December, 1921.

OCCUPATION OF SAKHALIN.—In Northern Sakhalin, according to reports from Russian sources, the Japanese are employing measures clearly indicating their intention of permanent occupation, including abolition of local self-government, classification of Russians as foreigners, and establishment of Japanese language, courts, and laws.

GREAT BRITAIN

ULSTER REFUSES TO ENTER IRISH STATE.—The Ulster Cabinet, in a letter to Premier Lloyd George published on December 15, definitely refused to enter the Irish Free State, choosing instead to exercise their privilege of maintaining a separate government under the Government of Ireland Act of 1920. The Ulster letter objected to the new oath as implying a lower standard of loyalty, and declared that the financial provisions of the agreement would introduce tariff war with England and internal disputes in Ireland. Objection was made to the provisions for altering the boundary between Ulster and the new state.

DISORDERS IN EGYPT.—Following the failure of negotiations between Great Britain and Egypt over the terms of Egyptian independence, the Egyptian premier, Sir Adley Yeghen Pasha, and his Cabinet resigned. No successor was immediately found, and the downfall of the government was followed by disorders in Alexandria and other cities, instigated by the Nationalist leader, Said Zaghlul Pasha. On December 23 Zaghlul was arrested in Cairo and taken to Suez. Two battleships and additional British military forces were dispatched to Egypt.

RESULTS OF INDIA NATIONALIST CONGRESS.—An All-Indian National Congress, representing the native agitation against British rule, was held at Ahmedabad on December 27-29. The primary result was the adoption of a resolution giving the native agitator, Mahatma Ghandi, sole executive power, and embodying a decision to carry on the anti-British campaign by all "legitimate and peaceful" means. This policy of

passive resistance includes non-payment of taxes and enrollment of volunteers.

The Congress declared that while aiming at *Swaraj*, or popular rule, it did not seek complete severance from the British Empire, provided the British people redressed India's wrongs. This was a concession to moderates in the convention. The *hartal*, or forced non-participation in activities accompanying the Price of Wales' visit, was attempted with varying success.

RUSSIA AND BALTIC STATES.

LITHUANIA REJECTS LEAGUE PLAN.—*Kovno, Lithuana, Dec. 28 (Associated Press)*—Lithuania has replied to the President of the Council of the League of Nations declining to accept the Council's recommendations for a settlement of the dispute between Poland and Lithuania over Vilna. The Lithuanian communication asks that Lithuania be permitted to elucidate her attitude at the next meeting of the Council.

The league of Nations' plan to terminate the dispute between Lithuania and Poland over Vilna, included the creation of two semi-autonomous Lithuanian cantons, one comprising the Vilna region and the other the remainder of Lithuania.—*New York Times*, 29 December, 1921.

TRADE AGREEMENT WITH ITALY.—*Rome, Dec. 27. (Associated Press).*—The terms of the commerical agreement between Italy and Soviet Russia, which was signed yesterday by Marquis della Torretta, the Foreign Minister, and M. Vorovsky, the Soviet representative, were published today by the Rome newspapers. It is merely temporary and provides for the resumption of trade between the two countries pending negotiations for a general economic treaty.

AMERICAN POLICY MORE FAVORABLE.—*Washington, Dec. 27.*—Changes in Soviet governmental policies, recently made—or indicated as in prospect—may eventually bring about a resumption of trade relations between Russia and the United States, it was said today at the White House.

Reports received recently by the American Government, it was added, were most optimistic as to the course likely to be pursued by the Soviet authorities.

The American Government, it was stated, already has responded to the change in Russian policy by admitting to the United States a Russian agent to buy grain for Russian relief enterprises.

The estimates recently submitted to Congress by the Administration, it was recalled today in other quarters, called for an appropriation for the salaries of two Trade Commissioners and one clerk in Russia.—*New York Times*, 28 December, 1921.

RUSSIA TO MAINTAIN ARMY.—*Moscow, Dec. 29 (Associated Press).*—The Soviet army and navy, now totaling 1,505,000 men, must not be reduced, but on the contrary must increase training and be prepared for war next spring and summer in the event that outside foes carry out their plans to attack Soviet Russia, declared Soviet Minister of War Trotzky in a fiery speech before the ninth All-Russian Congress today.

Trotzky announced to the Congress the capture of Khabarovsk, in Siberia, by the White Guards "in the presence of Japanese bayonets."

"Now can we remove our troops from the Far East?" he demanded rhetorically. "No. We can only regret there were not enough of them. But we are certain that in the future enough Red bayonets will be there to hold back the pressure."—*New York Times*, 30 December, 1921.

GERMANY AND CENTRAL EUROPE

DELAY IN REPARATIONS PAYMENTS.—In a note to the Reparations Commission on December 15 Chancellor Wirth of Germany stated that it was impossible to meet the reparations installments due on January 15 and February 15, amounting to one billion gold marks. Not more than 150,000,000 marks could be paid, apart from deliveries in kind and credit for "recovery acts"; and efforts to float a loan in Great Britain had failed.

One of the main purposes of the meeting of the Supreme Council at Cannes on January 6 was to consider the question of German payments. Prior to the meeting Premier Briand pledged himself to the French Chamber that he would insist that Germany fulfil all obligations. On the other hand it was tacitly agreed at the previous conference in London that Germany should be required to pay only 500,000,000 marks of the two billion due this year.

ODENBURG TO HUNGARY.—The plebiscite in December in the town and district of Odenburg resulted in a large majority for union with Hungary. The plebiscite was provided for by the protocol made at the Venice Conference on Austrian problems. While the Austrian Government consented to the plebiscite, the result was a severe disappointment. The Austrian president, Michael Hanish, afterward declared his unwillingness to ratify the Venice agreement, and denounced the plebiscite as illegal owing to the tardy removal of Hungarian troops from the district.

By pledging the famous Gobelin tapestries Austria succeeded at the close of December in raising a loan of £3,000,000 in London, sufficient to tide the country over until a further credit is granted through the League of Nations.

HUNGARIAN PEACE TREATY RATIFIED.—The Hungarian National Assembly on December 12, ratified the Treaty of Peace between the United States and Hungary. Count Széchényi was appointed American Minister.

LATIN AMERICA

TACNA-ARICA NEGOTIATIONS CANCELED.—Negotiations between Chile and Peru for arbitrating the Tacna-Arica dispute in Washington were dropped because of unwillingness on the part of Chile to submit to arbitration anything save Article III of the Treaty of Ancon relating to the method of holding a plebiscite in the disputed region. Peru, fearing the results of a plebiscite at this time, wished to reconsider the entire treaty. Chile rebuffed Bolivia's attempts to enter the negotiations in an effort to secure a sea outlet, declaring that Bolivia had no legitimate concern in the dispute.

ANTI-AMERICAN ACTIVITY IN MEXICO.—*Washington, December 25.*—While seeking American recognition of the Obregon Government, Mexico has been conducting propaganda in various parts of Latin America for alienation of the friendship of these countries from the United States and their definite alignment with Mexico, according to reports that are coming out through well-informed American and Latin-American sources.

These reports have it that at no time since Carranza conceived his hatred of the United States, has the campaign of propaganda initiated by him abated. The campaign, it is asserted, may be divided into three phases, as follows:

1. The attempt to induce the secession of Los Altos, that part of Guatemala adjoining Mexico on the west coast and its annexation to Mexico.

2. The support of the movement for a federation of Central America and its eventual union with Mexico.

3. The sending of diplomatic representatives to the Central American countries with instructions to work for federation, Mexican supremacy and hostility toward the United States.

Evidence of this conduct on the part of the Mexican Government is said to be in the files of the State Department.—*New York Times*, 26 December, 1921.

REVIEW OF BOOKS

INVENTION; THE MASTER-KEY TO PROGRESS, by Rear Admiral Bradley A. Fiske, LL.D., United States Navy—New York, E. P. Dutton & Co. $4.00.

Invention has assuredly not lacked annalists. Going no further back than the reign of King Charles II of England, we find the Marquis of Worcester inditing his quaint *Century of the Names and Scantlings of Such Inventions as at Present I Can Call to Mind and Have Tried and Perfected.* .After him, at diminishing intervals, comes a long line of successors, notably Beckmann in Germany at the end of the XVIIth Century, (whose classic *History of Inventions* translated into English, the reviewer's childhood's companion, still has a place on the shelves of his library); Edward Somerset, who in 1825, published *A Century of Inventions;* Edward Everett Hale, author, in 1887, of *Lights of Two Centuries;* not to mention scores of others at various times and in various languages. So far as the reviewer knows, all such works are strictly historical. They seldom fail to record a lively appreciation of the benefits brought to mankind by the inventor but do not create what may be termed a philosophy of invention. The facts are given, not always correctly, but with due credit to the inventors. That, underlying these gifts to humanity, there is a world-wide movement towards a desired but unrecognized end seems to have escaped the notice of the several writers. They could not see the wood for the trees.

And now comes one who unites in his own person certain qualities which are usually found existing apart and never before in one individual, for Admiral Fiske is author, naval officer and inventor. To these attributes must be added a fourth, that of philosopher. Granting freely the three which none will deny, let us consider the unclaimed status under the last head. But, first of all, we should clear the ground by stating briefly what material is contained in the book here reviewed. Substantially, it is a complete and most valuable running story of man's achievements in the line of the subject treated. The number of departments of human activity is surprisingly great. They embrace everything from prehistoric flint weapons to modern artillery; from the *Novum Organum* of Bacon to sewing machines; from spinning jennies to types of government; from Vasco da Gama to Pasteur!

The reviewer inclines to the opinion that more stress might well have been laid upon the invention—or discovery, as you will—of how to make a

fire. From that moment only, progress was possible and men permanently differentiated from animals. Civilization may be said to have begun then.

The attribution of the art of printing by metal types to John Gutenberg can not pass unchallenged in spite of the noisy tributes and the huge statue erected to his memory in Germany on the occasion of the five hundredth anniversary of his birth. The *Encyclopedia Brittanica* is absolutely positive in stating that "the invention of printing with movable metal types took place at Haarlem about the year 1445 by Lourens Janszoon Coster."

The author properly defines an invention as of three stages, "Conception, development and production." Applying this test to the case of Copernicus we find, as Admiral Fiske says, "Copernicus was not the first to conceive the idea that the earth turns on its own axis or that the earth revolves around the sun," the old Pythagorean theory that Copernicus doubtless absorbed in Padua when a student there. His great merit lies in "development and production," not in "conception." Hence it seems unfair to the ancient Greek astronomer to give the name "Copernican" to a system which Copernicus did not actually invent, although he did make it "usable."

Personally, the reviewer holds Pasteur to have been the greatest inventor, as well as benefactor, of the XIXth Century, with Lord Kelvin a close second. Upon Pasteur's work is based the modern practice of medicine and surgery. Without his preliminary labors, research and results, it is impossible to imagine how Eberth, Kock, Sternberg, Loeffler, and Nikolaier could have made their valuable discoveries. By his work on ferments, the malady of silk worms, rabies and anthrax, he proved that every infectious disease is due to a particular germ and later he developed the antitoxin which has saved countless lives. In short, Pasteur blazed the trail for those Germans and for Lister to follow. The latter, in a speech delivered in Paris in 1900 said he had done no more than seize upon Pasteur's discoveries and apply them to surgery. In view of these facts it would appear that the author has given Pasteur less than his due meed of praise. One wonders whether the authorities chiefly consulted were not predominantly German.

Again, the reviewer seems to remember a slotted screw breech plug in a gun much older than 1849, the date ascribed to this invention.

Admiral Fiske states in italics that *"The Monitor's battle was the only battle* [in the Civil War] *in which the light of genius shone on either side."* Was not Farragut's running past Forts Jackson and St. Philip to reach his real objective, the city of New Orleans, a stroke of genius?

The remarks immediately preceding are to be taken as suggestions of what might possibly have been more strictly just rather than as carrying criticism.

We are accustomed to regard "an invention" as something material and tangible, hence the author's employment of that word in connection with systems of philosophy, methods of government and modes of conducting warfare comes as a surprise. Nevertheless, by his definition, already quoted, it is abundantly warranted and Alexander, Cæsar, von Moltke,

Francis Bacon, the founders of our own Constitution, may rightly be classed among inventors since their work is characterized by the three conditions, "conception, development and production." Nor can this distinction be denied to Archimedes; to Hero, who made the first steam engine; to the unknown creator of the *"corvus"* which gave the Romans victory over the Carthaginian fleet; or to the maker of Greek fire, which routed a Turkish fleet in the VIIth Century. To all of these, among many others, Admiral Fiske does honor in this extremely interesting volume.

Speaking of the gun, through which lasting superiority over the barbarians was assured to, and is maintained since by, civilized man, the author pertinently calls attention to an unrecognized yet most important feature common to all inventions in words which merit careful study, "As the gun was a piece of mechanism, it possessed the attribute which seems to give to pieces of mechanism an element of superiority over every other thing in the universe, the attribute of continual improvability. Human beings do not possess this attribute, nor does any other thing in nature, so far as we know." By this expression he does not, it is presumed, mean that, by careful selective breeding, the best that is in plants and animals may not be brought out and made more or less permanent, but these possibilities are already existent even when latent. Indeed, the writer goes on to say, "Every human being begins where his father did—and so does everything else on earth; though human invention has recently made it possible for certain plants to be improved [as mentioned in the foregoing sentence]. No new invention ever dies as a man does, even if the material parts or immaterial parts that compose it are destroyed. On the contrary, it lives, in the sense that it exists as a definite usable entity, and also in the sense that it continues to propagate. And the things that it propagates do not begin as helpless and useless babies, but as mature creations. The first completed gun is still the model for the gun that men make now, and will continue to be the model for all guns in the future." (p. 106).

The subsequent remark (p. 326), a summation of these ideas, is strikingly true: *"The influence of invention is cumulative."* The italics are his own. Nor is this reflection less suggestive: "Now to bring the gun and its accessories to the high standard they have now reached, the resources of virtually all the physical sciences have been required and utilized so that, while modern civilization was made possible by the gun, and could not have been made possible without it, the modern gun has been made possible by civilization and could not been made possible without it. This mutuality between civilization and the gun is evident in the relations between civilization and every other great invention." (p. 108.)

The principal events in the history of invention, which necessarily includes the development of the physical sciences, are touched upon but only too briefly, the modest size of this volume forbidding lengthy treatment. None are overlooked, hence the book may be accepted as a trustworthy *vade mecum* to him who seeks to penetrate more deeply into its fascinating subject.

Particularly valuable are the author's observations of the "Machine of Civilization," the result of countless inventions and on the necessity as well as dearth of trained men to operate the "Machine of Government." "But the Machine of Civilization is composed not only of material parts, such as come within the province of the engineer, but also of immaterial parts; in fact, the principal parts are men, and especially the minds of men. It is the office of the Machine of Government to handle the men. It is also its office to direct their minds; because unless those minds view things correctly, the Machine of Government cannot work with smoothness. Now, men are inferior to machines in one important way: men, as men, cannot be improved. It therefore devolves on Government continuously to instruct and train men to handle the Machine of Civilization carefully, because the machine is being made more and more complicated, and more and more in need of intelligent care, with every passing day.

"Is this fact realized? I fear not. No sign is visible to the author of these pages that the people in any country realize or even suspect that there is any need for looking out for the integrity of the Machine as a whole. The closest approximation to it is a belated realization that the Bolsheviki are a danger to 'society.' The people do not even seem to realize the necessity of having competent experts at the head of government affairs." (p. 225.)

Furthermore, "it is a well known fact that though there are but few men in the world so wise and learned that they know much about the Machine or any of the parts, yet it is not from the wise and learned class that the great officials of government are selected." (p. 335.)

There is a despairing note in his exclamation, "*In no country is there any serious effort made to train men to operate the Machines of Government.*" (p. 229. Italics the author's.)

The ancient Athenians knew better and they examined aspirants for public office as to their qualifications.

The author may be pardoned for his remarks (p. 328) in connection with one of the many children of his fertile brain—the torpedo-plane. "During the World War, it played only a subordinate part, though it was used effectively by the British and the Germans. Our Navy did not use it at all, as Secretary Daniels rejected it." Of course he did—what else could have been expected of such a person? Still we can all sympathize with the author in his professional resentment at the stands taken by Mr. Daniels.

The reading of this exceptionally valuable and interestingly written book might well begin with the two concluding chapters which give a broad view of the whole subject and place the student in the mental attitude of the writer thus enabling him the more readily to follow the drift of the argument. That invention is indeed the main factor in progress, or according to Admiral Fiske's phrase "The Master Key," may well be admitted as proved, pacifists and transcendentalists to the contrary notwithstanding.

It will be observed that the reviewer touches very lightly upon individual inventions. Their number is so vast that all could not even have been alluded to; while to select a few and ignore the others would have been eminently unfair since no two persons are likely to agree upon the choice. The remedy is obvious. Let those interested read the whole book and each arrive at his own conclusion as to relative importance. To the naval profession the volume is highly commended. It points out the possibility of improving our own material and morale in countless ways now unappreciated and the obligation resting upon every one of us to use his eyes and his brain; the former to perceive what is needed to carry our trade still further along the road to perfection, the latter to devise the means for approaching that end. Let all naval officers, then, strive to become inventors, although, through lack of imagination, many shall fail.

Having studied Admiral Fiske's pages attentively, we are now in a position to assert that in them is revealed a hitherto unrecognized generalization which binds together as parts of one great whole all advances in art, science, government, philosophy and even religion. As the proponent of this new system are we not justified in contending that its author amply merits the title of philosopher?

C. F. G.

THE GREAT DECEPTION, by Samuel Colcord. Price $1.50. (Boni and Liveright, New York.)

The intent of this book is to clear up the uncertainty in many minds to whether or not the election of Mr. Harding indicated that the people of the United States were averse to entering a League of Nations or similar organization.

As an endeavor to present a case clearly, honestly and convincingly, this little book is a model of the highest degree of excellence. It is difficult to imagine what the author could have done to make the book fulfil its declared mission more perfectly; every aspect of the situation seems to have been examined, every important fact correctly stated, every argument on both sides impartially considered.

But while one admires the heartfelt sincerity that permeates its pages, and loves its Christian kindliness, and almost loves its author, a man familiar with naval and military history can hardly fail to realize that its influence must, in the main, be dangerous: not because of what it directly teaches, but of what it unconsciously suggests.

For the whole apparent inspiration to the writing of the book, the sole reason for the importance attached to it by many persons, is the virtual assumption that peace can be made permanent by mere agreement, among mere human beings.

If the book (or any other book), presented a plan, or even a suggestion, for preventing war that was even a little novel; if it outlined any scheme not tried a thousand times already; if there were any indication of an

Engineering MAR 22 1922

attempt to visualize world conditions even ten years beyond the present, one would not feel so discouraged. But at this moment, when the war is hardly over, while the wails of the taxpayers are sounding in our ears—to see the same ideas advanced as caused our unpreparedness, with its resulting exorbitant expenditure of blood and money—tends to give one a hopeless feeling about our future.

This book and many similar utterances make us feel that the dead have really died in vain, that the United States will again do as she has five times done already, and drift along in unpreparedness to an inglorious war; maybe next time, to disaster.

B. A. F.